Faribault County Minnesota Soils

Soil Survey Series 1947 No. 2
UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
UNIVERSITY OF MINNESOTA AGRICULTURAL EXPERIMENT STATION

How to Use THE SOIL SURVEY REPORT

FARMERS who have worked with their soils for a long time know about the soil differences on their farms, and perhaps about differences on the farms of their immediate neighbors. What they do not know, unless soil surveys have been made, is how nearly their soils are like those on experiment stations or on other farms, either in their State or other States, where farmers have gained experience with new or different farming practices or farm enterprises. They do not know whether higher yields obtained by farmers in other parts of their county and State are from soils like theirs or from soils so different that they could not hope to get yields as high, even if they followed the same practices. One way for farmers to avoid some of the risk and uncertainty involved in trying new production methods and new varieties of plants is to learn what kinds of soils they have so that they can compare them with the soils on which new developments have proved successful.

SOILS OF A PARTICULAR FARM

A colored soil map accompanies this report. To find what soils are on any farm or other land, it is necessary first to locate this land on the map. This is easily done by finding the township in which the farm is located and by then using landmarks such as roads, streams, villages, dwellings, and other features to locate the boundaries.

Each kind of soil mapped within the farm or tract is marked on the map with a symbol. For example, all the areas marked Tb are Truman silt loam, 1 to 5 percent slopes. The color in which the soil area is shown on the map will be the same as the color indicated in the legend for the particular type of soil. If you want information on the Truman soil, turn to the section in this publication, Soils of Faribault County, Their Use and Management, and find Truman silt loam, 1 to 5 percent slopes. Under this heading you will find a statement of what the characteristics of this soil are, what the soil is mainly used for, and some of the uses to which it is suited.

Suppose, for instance, you wish to know the kind of yields Truman silt loam, 1 to 5 percent slopes, can be expected to produce. You will find the soil listed in the left-hand column of table 3. Opposite the name you can read the yields for the different crops grown on it. This table also gives estimated yields for all the other soils mapped in the county.

If, in addition, you wish to know what uses and management practices are recommended for Truman silt loam, 1 to 5 percent slopes, read what is said about this soil in the section, Soils of Faribault County, Their Use and Management. Refer also to the section headed, Principles of Good Soil Management, where the soils suited to the same uses and management practices are grouped together.

SOILS OF THE COUNTY AS A WHOLE

A general idea of the soils of the county is given in the section, How the Soils of Faribault County Were Formed and How They Are Classified. After reading this section, study the soil map and notice how the different kinds of soils tend to be arranged in different parts of the county. These patterns are associated with well-recognized differences in type of farming, land use, and land use problems. The different shades or colors indicate groups of soils that require different kinds of management.

A newcomer to the county, especially if he considers purchasing a farm, will want to know about the climate; the types and sizes of farms; the principal farm products and how they are marketed; the kind and conditions of farm tenure; availability of roads, railroads, electric services, and water supplies; the industries of the county; and cities, villages, and population characteristics. Information about all these will be found in the section, General Features of Faribault County.

Those interested in how the soils of the county were formed and how they are related to the great soil groups of the world should read the section, Morphology of the Soils of Faribault County.

This publication on the soil survey of Faribault County, Minn., is a cooperative contribution from the—

SOIL CONSERVATION SERVICE

and the

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Faribault County, Minnesota, Soils

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(Field work for this survey was done while Soil Survey was a part of the Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration. Soil Survey was transferred to Soil Conservation Service, November 15, 1952.)

UNITED STATES DEPARTMENT OF AGRICULTURE

Soil Conservation Service

In cooperation with

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CONTENTS

SOIL RESOURCES OF FARIBAULT COUNTY

THE VALUABLE SOILS of Faribault County have made it one of the major food-producing counties in the United States. It is located in the south-central part of Minnesota in a highly productive farming area, and is the center county of the 9 that border Iowa (fig. 1). The distance from Blue Earth to Mankato is 35 miles, and to the twin cities of Minneapolis and St. Paul, 100 miles. The county is 30 miles long and 24 miles wide and has a total land area of 712 square miles or 456,300 acres.

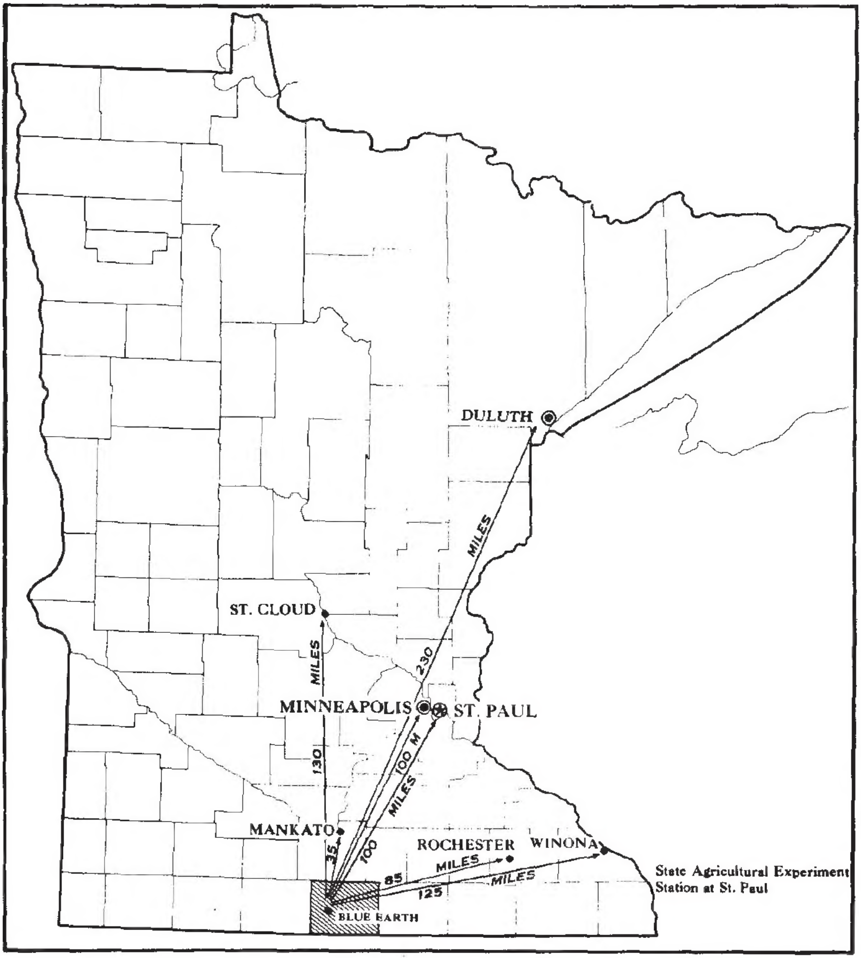

Figure 1.—**Location of Faribault County in Minnesota.**

The farmers of Faribault County have realized the importance of utilizing the great soil resources. Practically all of the soil in the county is in cultivation. On most farms excellent yields of the major crops—corn, oats, and soybeans—are obtained. Many fertile but naturally poorly drained soils have been made more productive by artificial drainage, and bountiful harvests are now possible on land previously unsuited to cropping. Improved tillage methods through better use of power machinery have also contributed to higher yields. Among other good soil-management practices that are less extensively applied are crop rotation, application of commercial fertilizers and other soil amendments, and erosion and weed control. In order to realize the greatest potentialities of the soils, it is essential that these and other soil-management practices be fitted to each soil.

To learn more about the capability and the best agricultural uses of the many different soils, a cooperative soil survey of Faribault County was made by the United States Department of Agriculture and the University of Minnesota Agricultural Experiment Station. Field work in this survey, an integrated part of the nationwide soil survey, was completed in 1947. Unless otherwise specifically mentioned, all statements in this report refer to conditions in the county at that time.

HOW THE SOILS WERE MAPPED AND CLASSIFIED

Soil surveyors made many hundreds of examinations of both the surface layer and the lower layers of the soils in Faribault County. Their observations were recorded on aerial photographs and in notes. When a surveyor observed differences in the surface soil or in the subsoil, or in both, that were great enough to justify mapping the area as another kind of soil, he located his position on the aerial photograph and then drew lines to separate the kinds of soil. The aerial photographs on which the soil separations were recorded and classified as series, types, phases, complexes, and miscellaneous land types were then compiled and a soil map of all the soils of the county was prepared.

The prepared soil map accompanies this report. It depicts by means of lines and colors the various soils of the county. The way to use this map is explained inside the front cover of this report.

A soil is named for the place in which it was first located and identified. For example, Truman soil is named for the village of Truman in adjacent Martin County, and Storden for a village in Cottonwood County, Minn.

Soils are classified according to their external characteristics and the nature of the soil profile.

A soil profile is a vertical cross section of the soil made up of layers, or horizons, called surface soil, subsurface soil, subsoil, and, in some cases, substratum.

Important characteristics of the soil are color, texture, structure, consistence, organic-matter content, reaction, drainage, porosity, depth or thickness of layers, stoniness, and relief.

A detailed description of the most representative soil type for each series in the county is given in the section, Soils of Faribault County, Their Use and Management. The entire soil profile, not the surface soil alone, is described. Soil types and phases have been grouped

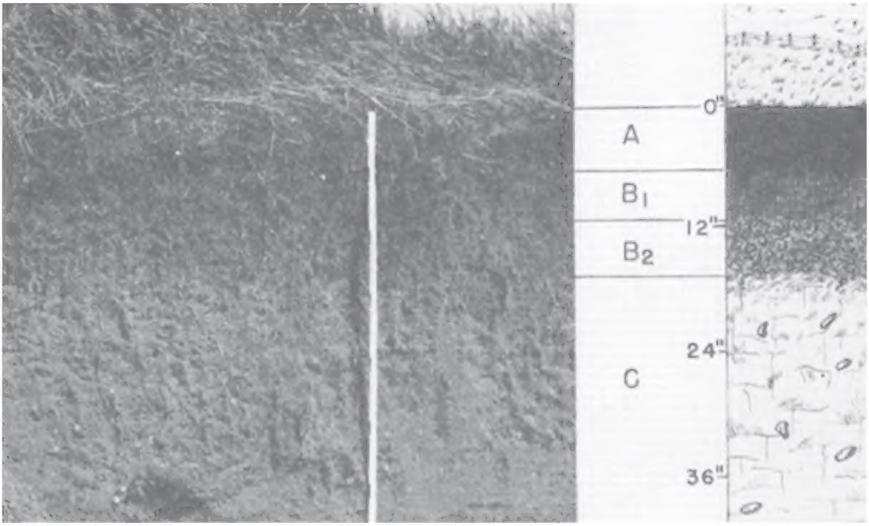

Figure 2.—**Profile of Clarion loam, 8 to 12 percent slopes, and sketch showing horizon differentiation.**

with the series they represent, and only their variations from the detailed description of the series are given. Readers who desire a better understanding of the nature, origin, and classification of the soils should study the more technical discussion in the section, How the Soils of Faribault County Were Formed and How They Are Classified.

A soil profile, which shows the layers, or horizons, of the dark-colored Prairie soil identified as Clarion loam, 8 to 12 percent slopes, is given in figure 2. This profile is described briefly as follows:

Depth (Inches)	*Horizon*	*Material*
0 to 6	A	Very dark grayish-brown friable granular loam.
6 to 11	B_1	Grayish-brown loam.
11 to 17	B_2	Yellowish-brown loam.
17 to 42	C	Light yellowish-brown friable loam till.

The dark-colored, friable, medium-textured surface layer is only partly responsible for the high productivity of this soil. The lower layers also contribute to the capacity of the soil to produce high yields.

Soils occupy areas, not merely points where they have been examined. Within a given area of Clarion loam, 8 to 12 percent slopes, for example, a series of cuts or profiles would show minor differences not agriculturally significant.

The topographic relationship of the different soils in the county is shown in figure 3.

SOIL CHARACTERISTICS

In addition to the more complete description of each soil given in the section, Soils of Faribault County, Their Use and Management, summaries of important characteristics that differentiate one soil from

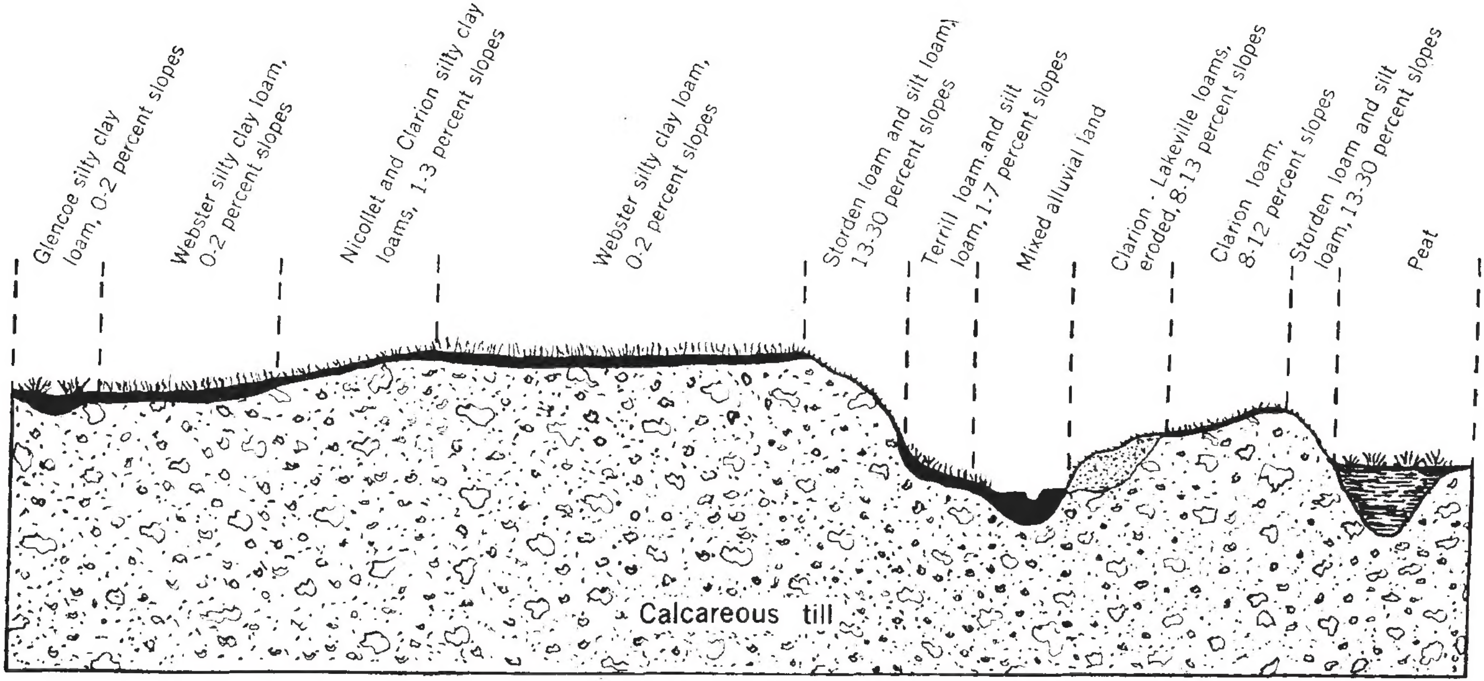

Figure 3.—**Schematic cross section showing relation of soils and topography in Faribault County.**

another are given in tables 1 and 2. Note that each soil differs in two or more inherent characteristics but that one of the characteristics generally dominates the others.

Many soil characteristics affect use, management, and productivity. Those characteristics considered most important in Faribault County are:

1. Color, thickness, and organic-matter content of the surface soil.
2. Drainage.
3. Texture, consistence, and structure of the surface soil and lower layers.
4. Slope.
5. Degree of erosion.
6. Depth to material unfavorable for root development.
7. Available plant nutrients and lime content.

Color, thickness, and organic-matter content of the surface soil

The soils of Faribault County are high in organic matter and dark in color. Conditions of climate and vegetation have favored the accumulation of large quantities of organic matter in the surface layer. The top layer is thick and dark, the usual depth is from 12 to 15 inches, and the color when moist ranges from dark brown to black. Extremes in depth of the surface layer are not uncommon, however, and variations ranging from 5 to 30 inches have been observed. The depth and organic-matter content of the mineral soils are greatest in the nearly black Comfrey, Glencoe, and Lura series and least in the brown Storden and Dickinson. Peats and Mucks consist almost entirely of organic matter and may extend to depths greater than 4 feet.

Drainage

A well-drained soil is one in which air and water readily move downward through the subsurface layer and subsoil. Estimates on how rapidly water moves through the various soils are given in table 1. Drainage is rapid to very rapid in sandy soils like the Dickinson. A uniformly bright brownish-yellow or brown subsoil indicates good internal drainage. Water and air movement through the poorly drained Marna and Beauford soils is slow to very slow, and roots penetrate the subsoil with difficulty. Some soils are wet because of their high water table, although water otherwise would move freely through them. This is true of some areas classified under the miscellaneous land type, Beach sand. Peats and Mucks are also wet because of a high water table. But in these soils as well as in the Beach sand, the water table is readily lowered by use of open ditches. Lura silty clay, 0 to 2 percent slopes, is an example of a soil with a high water table and very restricted water movement.

Texture, consistence, and structure of the surface soil and lower layers

Most of the soils in Faribault County have a moderately fine or fine textured surface soil, a sticky consistence, when wet, and a

TABLE 1.—*Some important characteristics of soils of Faribault County, Minn., that affect management*

Map symbol	Soil	Drainage through soil	Moisture-supplying capacity	Erosion hazard	Natural fertility	Special soil-management problems
Ba	Beach sand [1]	Rapid	Fair to poor, depending on depth to water table.	Wind erosion	Low	Wind erosion control; fertility improvement.
Bb	Beauford silty clay, 0 to 2 percent slopes.	Very slow	Seasonal—excessive in spring, very good rest of growing season.	None	High	Artificial drainage; good tilth maintenance; fertility maintenance.
Bc	Blue Earth silty clay loam, 0 to 2 percent slopes.	Medium to slow	Very good to excessive	Subject to wind erosion.	Low in available mineral nutrients.	Artificial drainage; flood control; wind erosion control; fertility improvement.
Ca	Clarion fine sandy loam, 1 to 7 percent slopes.	Medium to rapid	Fair to good	Slight	Moderately high	Sheet erosion control; fertility maintenance.
Cb	Clarion fine sandy loam, 8; 20 percent slopes.	Medium to rapid	Fair to good	Moderate	Moderate	Erosion control; fertility maintenance.
Cc	Clarion-Lakeville loams, eroded, 8 to 13 percent slopes.	Clarion—medium; Lakeville medium to rapid.	Clarion—fair to good; Lakeville—poor.	Severe	Clarion—moderate; Lakeville—low.	Erosion control; fertility improvement.
Cd	Clarion loam, 8 to 12 percent slopes.	Medium	Fair to good	Moderate to severe	Moderately high	Erosion control; fertility maintenance.
Ce	Clarion silt loam, 2 to 7 percent slopes.	Medium	Good	Moderate	Moderately high	Sheet erosion control; fertility maintenance.
Cf	Comfrey silty clay loam, 0 to 1 percent slopes.	Slow	Seasonal: excessive in spring; good rest of growing season.	Stream bank erosion	High	Artificial drainage; streambank erosion control; flood control.
Da	Dickinson fine sandy loam, 1 to 7 percent.	Rapid	Poor	Subject to sheet, gully, and wind erosion.	Moderately low	Erosion control; fertility improvement; moisture conservation.
Db	Dickinson fine sandy loam, 8 20 percent slopes.	Rapid	Poor	Same	Moderately low	Same.
Dc	Dickinson loamy fine sand, 1 7 percent slopes.	Rapid to very rapid	Very poor	Subject to wind erosion.	Moderately low	Same.
Dd	Dickinson loamy fine sand, 8 to 20 percent slopes.	Rapid to very rapid	Very poor	Severe	Moderately low	Same.
Ga	Glencoe silty clay loam, 0 to 2 percent slopes.	Slow to medium	Very good	None	Moderately high	Artificial drainage; good tilth maintenance; fertility maintenance.
Gb	Guckeen silty clay loam, 1 to 3 percent slopes.	Slow	Good	None	High	Good tilth and fertility maintenance.
Gc	Guckeen silty clay loam, 2 to 7 percent slopes.	Slow	Good	Slight	High	Sheet erosion control; good tilth maintenance; fertility maintenance.
Ha	Harpster silty clay loam, 0 to 2 percent slopes.	Medium to slow	Very good	Slight wind erosion	Low in available minerals.	Drainage; fertility improvement.
La	Lura silty clay, 0 to 2 percent slopes.	Very slow	Very good to excessive	None	High	Artificial drainage; good tilth maintenance, fertility maintenance.

Ma	Marna silty clay loam, 0 to 2 percent slopes.	Slow to very slow	Very good	None	High	Artificial drainage; good tilth maintenance; addition of phosphate fertilizer.
Mb	Marna silty clay loam, 2 to 5 percent slopes.	Same	Very good	Slight sheet erosion	High	Artificial drainage; sheet erosion control; good tilth and fertility maintenance.
Mc	Marsh	Ponded	Excessive	None	High	Recommended for wild life.
Md	Mixed alluvial land [2]	Variable	Variable	Stream bank erosion and stream deposition.	Variable	Stream bank erosion control; flood control.
Me	Muck [3]	Medium to slow	Very good to excessive.	Subject to wind erosion.	High in nitrogen but low in mineral nutrients.	Artificial drainage; control of water table; wind erosion, fire hazard and flood control; addition of mineral nutrients.
Mf	Muck, shallow phase [3]	Medium to slow	Same	Same	Same	See Muck.
Na	Nicollet and Clarion silty clay loams, 1 to 3 percent slopes.	Medium to slow	Good	Slight	High	Sheet erosion control; fertility maintenance.
Pa	Peat [3]	Medium			High in nitrogen but low in mineral nutrients.	
Pb	Peat, shallow phase [3]	Medium	Very good to excessive.	Subject to wind erosion.	Same	
Sa	Storden-Lakeville loams, eroded, 13 to 30 percent slopes.	Storden—medium; Lakeville—medium to rapid.	Poor to fair	Severe	Moderately low	Erosion control; fertility improvement; land use adjustment.
Sb	Storden loam and silt loam, 13 to 30 percent slopes.	Medium	Poor to fair	Severe	Moderately low	Same.
Ta	Terril loam and silt loam, 1 to 7 percent slopes.	Medium	Good	Slight	High	Sheet erosion control.
Tb	Truman silt loam, 1 to 5 percent slopes.	Medium	Good	Moderate	Moderately high	Erosion control; fertility maintenance.
Tc	Truman silt loam, 6 to 12 percent slopes.	Medium	Fair	Severe	Moderate	Same.
Va	Volin silt loam, 0 to 2 percent slopes.	Medium	Good	Very slight to none	High	Occasional flood hazard control; fertility maintenance.
Wa	Webster silty clay loam, 0 to 2 percent slopes.	Medium to slow	Very good	None	High	Artificial drainage; fertility maintenance.

[1] 1 to 3 percent slopes.
[2] 0 to 2 percent slopes.
[3] 0 to 1 percent slopes.

granular to fine subangular blocky structure. About 75 percent of the mineral soils are fine or moderately fine textured, ranging from silty clay loam to silty clay. About 2.5 percent are coarse or moderately coarse textured, ranging from loamy fine sand to fine sandy loam. The rest are medium-textured soils -loams and silt loams. The fine and moderately fine textured soils are difficulty to work, sticky when wet, and high in water-holding capacity. In contrast, the coarse or moderately coarse textured soils are easy to work, loose in consistence, and low in water-holding capacity. In general, the fine or moderately fine textured soils have a very stable fine subangular blocky to granular surface soil structure; the medium-textured soils have an unstable granular structure; and the coarse or moderately coarse textured soils have an unstable granular to crumb structure.

Blue Earth silty clay loam, 0 to 2 percent slopes, and Harpster silty clay loam, 0 to 2 percent slopes, have fine to very fine granular structure, probably because of the high organic-matter content and excessively high lime content in their surface soils.

Slope

The slope of the soils is shown as a percentage. For example, a slope of 8 percent has 8 feet of rise or fall for every 100 feet of horizontal distance.

More than 60 percent of the soils in Faribault County are nearly level; that is, they have slopes of less than 2 percent (fig. 4). These nearly level soils generally are not subject to sheet erosion. The coarse-textured soils on slopes of less than 2 percent, however, are subject to wind erosion. Soils on undulating slopes (2 to 7 percent)

***Figure 4.*—Typical nearly level landscape in Faribault County; partly prepared seedbed is on Webster silty clay loam, 0 to 2 percent slopes.**

TABLE 2.—*Properties of the soil types of Faribault County, Minn.*

Parent material and soil type or complex	Topographic position	Relief	Natural drainage class	Surface soil			Subsoil			
				Color	Consistence	Approximate thickness	Color	Consistence	Texture	Approximate thickness
Calcareous friable loam till:						*Inches*				*Inches*
Clarion loam	Moraine	Gently rolling	Well drained	Very dark grayish brown	Friable	7–12	Dark brown to yellowish brown.	Friable	Loam	12–20
Clarion silt loam	Till plain and ground moraine.	Undulating	Well drained	Same	Friable	10–14	Dark grayish brown to grayish brown.	Friable; slightly plastic when wet.	Loam to light clay loam.	10–20
Glencoe silty clay loam	Slightly depressed flats	Nearly level	Very poorly drained	Black	Firm when moist, sticky when wet.	15–30	Dark gray to light olive gray (mottled in lower part).	Plastic	Silty clay loam	10–15
Nicollet and Clarion silty clay loams:										
Nicollet silty clay loam	Till plain	Gently undulating	Moderately well drained.	Very dark brown	Friable	12–14	Yellowish brown (slightly mottled in lower part)	Firm when moist, slightly plastic when wet.	Silty clay loam	10–20
Clarion silty clay loam	Till plain and ground moraine.	Gently undulating	Well drained	Very dark grayish brown	Friable	10–14	Dark grayish brown to yellowish brown.	Same	Silty clay loam	10–20
Storden loam and silt loam	Terminal moraine	Rolling to hilly	Somewhat excessively drained.	Brown to grayish brown	Very friable	0–8	Brownish gray to brownish yellow.	Friable	Loam	0–6
Webster silty clay loam	Till plain	Nearly level	Imperfectly to poorly drained.	Black to dark gray	Friable to firm when moist, slightly sticky when wet.	12–18	Dark gray to olive (mottled).	Firm when moist, plastic when wet.	Silty clay loam	10–20
Harpster silty clay loam	Till plain	Nearly level	Same	Dark gray; gray when dry.	Very friable to fluffy	8–18	Dark gray to gray (mottled).	Friable when moist, moderately plastic when wet.	Silty clay loam	10–20
Clarion-Lakeville loams:										
Clarion loam	Moraine	Undulating to gently rolling.	Well drained	Dark grayish brown	Friable	7–12	Yellowish brown to brown	Friable	Loam	12–20
Lakeville loam	Moraine	Gently rolling	Somewhat excessively drained.	Dark grayish brown	Very friable	5–10	Dark brown to brown	Friable	Loam	10–20
Storden-Lakeville loams:										
Storden loam	Moraine	Rolling to hilly	Somewhat excessively drained.	Brown to grayish brown	Very friable	0–8	Brownish gray	Friable	Loam	0–6
Lakeville loam	See Clarion-Lakeville above.									
Lacustrine clays and lake-washed till:										
Guckeen silty clay loam	Glacial lake and till plain	Nearly level to gently undulating.	Imperfectly to moderately well drained.	Dark brown and very very dark grayish brown.	Firm when moist, plastic when wet.	9–18	Dark brown and dark gray, slightly mottled in lower part.	Very firm when moist, very plastic when wet.	Silty clay	14–24
Marna silty clay loam	Glacial lake and till plain	Nearly level to gently undulating.	Poorly drained	Black	Firm when moist, sticky when wet.	14–18	Very dark gray to olive (slightly mottled).	Firm to very firm and waxy when moist, plastic to very plastic when wet.	Silty clay	14–24
Beauford silty clay	Lake plain	Nearly level	Poorly drained	Black to very dark gray	Same	12–20	Dark grayish brown to olive gray.	Waxy and firm when moist, very plastic when wet.	Clay and silty clay	15–20
Lura silty clay	Slightly depressed flats in lake and till plain.	Nearly level	Very poorly drained	Black	Same	15–30	Dark gray to light olive gray (mottled).	Very firm when moist, very plastic when wet.	Silty clay and clay	14–24
Blue Earth silty clay loam	Glacial lake basins	Nearly level	Very poorly drained	Dark brownish gray and very dark gray (gray when dry).	Friable	15–24	Dark gray to light yellowish brown slightly mottled.	Friable to firm when moist, plastic when wet.	Silty clay loam to clay loam.	15–20
Fine sandy loam over calcarous friable loam till:										
Clarion fine sandy loam	Till plain and ground moraine.	Undulating to gently rolling.	Well to somewhat excessively drained.	Dark grayish brown	Very friable	8–15	Grayish brown to yellowish brown.	Friable	Loam	15–25
Water-reworked silty till:										
Truman silt loam	Dunelike and morainic ridges on lake and till plains.	Gently undulating to gently rolling.	Well drained	Very dark grayish brown	Very friable	7–14	Grayish brown to brown	Friable	Silt loam	20–30
Sandy drift:										
Dickinson fine sandy loam	Dunelike and morainic hills and ridges.	Undulating to rolling.	Well to somewhat excessively drained.	Dark grayish brown to grayish brown.	Very friable	6–12	Brown to brownish yellow	Friable	Sandy loam to loam	10–18
Dickinson loamy fine sand	Same	Undulating to rolling.	Somewhat excessively to excessively drained.	Same	Very friable	6–12	Same	Friable to very friable	Sandy loam	10–18
Beach sand:										
Beach sand	Shorelines of lakes and former lakes.	Nearly level	Well to somewhat excessively drained.	Gray	Loose		Gray	Very friable	Fine sand to sandy loam.	
Colluvium:										
Terril loam and silt loam	Foot slopes	Gently undulating	Well drained	Black	Friable	16–30	Dark gray	Friable	Loam to clay loam	12–18
Alluvium:										
Comfrey silty clay loam	Flood plain	Nearly level	Imperfectly to poorly drained.	Black and dark gray	Firm when moist, slightly sticky when wet.	15–24	Dark gray and gray	Firm when moist, plastic when wet.	Silty clay loam	12–24
Volin silt loam	Flood plain	Nearly level	Moderately well drained.	Very dark brown and grayish brown.	Friable	12–18	Dark gray to gray (slightly mottled).	Same	Silty clay loam	15–20
Mixed alluvial land	Flood plain	Nearly level	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Variable.
Mixed organic and mineral materials:										
Peat	Depressed flats	Nearly level	Very poorly drained	Very dark grayish brown	Very friable	12–60				
Muck	Depressed flats	Nearly level	Very poorly drained	Black	Very friable	8–36	Brown	Friable		
Marsh	Depressed flats	Nearly level	Very poorly drained							

are slightly to moderately subject to sheet erosion. Gently rolling land, which has slopes of 7 to 13 percent, is moderately to highly subject to sheet and gully erosion and requires careful handling when cropped. Rolling land, with slopes of 13 to 20 percent, is too steep for continuous cultivation; and hilly land, with slopes of more than 20 percent, should be used for hay and pasture only.

Degree of erosion

Erosion varies from field to field. Severe erosion may result from improper land use, steep slope, erosive soil, or any combination of the three. It seems likely that soil with severe erosion has been

***Figure 5.*—Area of Storden loam and silt loam, 13 to 30 percent slopes, showing proper land use for steeper soils.**

mishandled. No accurate estimates were made of the degree of erosion on different soils in the county. Many of the cultivated soils in the county are subject to erosion and have been eroded to varying degrees. Only one mapping unit, however—Clarion-Lakeville loams, eroded, 8 to 13 percent slopes—had erosion so advanced that it was necessary to map it as eroded. This unit has slopes vulnerable to erosion, but it appears to have been cultivated about as intensively as less susceptible soils. Storden loam and silt loam, 13 to 30 percent slopes (fig. 5), is inherently as erosive as the Clarion-Lakeville unit, but because it has not been mishandled to so great a degree, has not eroded so badly. Erosion in fields may be estimated by examining the thickness of the surface soil and comparing it with the thickness given for the particular soil in the map supplement. Other evidences of erosion are spots in the fields where lighter colored subsoil is exposed, local deposits of surface soil in draws and drainageways and along old fence rows, and old plowed-in gullies.

Depth to material unfavorable to root development

Some soils may have surface layers favorable to root growth but subsoils with unfavorable characteristics. The Lakeville soils in the Clarion-Lakeville loam and Storden-Lakeville loam complexes have mixtures of gravel and sand at depths of 18 inches that are unfavorable to root development because they hold so little water. A few of the finer textured soils like the Lura and Beauford have a tight clay subsoil also unfavorable to root growth. Most of the other soils in Faribault County have subsoils favorable to root growth.

Available plant nutrients and lime content

The amount of plant nutrients and lime in soils vary not only from one series to another but also within each soil series and type. The best means of determining shortages is to have a sample of the soil tested at the Soil Testing Laboratory operated by the Minnesota Agricultural Experiment Station, as explained in the section, Principles of Good Soil Management. As a whole, the soils of Faribault County are well supplied with lime. Tests indicate, however, that a few may be slightly deficient, and that others, such as Blue Earth silty clay loam, 0 to 2 percent slopes, contain so much lime that it throws the supply of other plant nutrients out of balance.

WHAT YIELDS CAN BE EXPECTED FROM THE SOILS

High yields over a period of years are due not only to good soils but to good soil management. Each soil has inherent characteristics that show its capability and determine its most suitable use. Low yields may be the result of unfavorable soil conditions, the use of crops not adapted to a particular soil, faulty management, or any combination of the three.

The average acre yields to be expected from important crops grown in Faribault County are given for each soil in table 3. These yields are based on the management recommended in table 5. Management will vary from soil to soil, as there is no key set of practices that will insure profitable farming on all soils.

Estimates were reached through field observations and interviews with farmers. The high yields given in the table have already been realized by many farmers. Some of the yields in the table have been checked against information from test demonstrations carried out by the Minnesota Agricultural Experiment Station.

If soil yields have not been as high as those given in table 3, it will be profitable to examine the management practices used on the farm

Crop yields in Faribault County can be substantially increased through correct use and good management of the soil. Average crop yields and estimated countywide increases readily attainable through the use of better management practices recommended for the different soils are given in table 4.

Table 3.—*Estimated average acre yields of principal crops on soils of Faribault County, Minn., under recommended management*

[Blank spaces indicate either that the soil is not planted to the crop named or that the system of management does not include this crop in the rotation]

Soil	Map symbol	Corn	Soybeans	Oats	Barley	Flax	Corn silage	Clover, timothy, and bromegrass	Alfalfa or alfalfa-bromegrass	Rotation pasture [1]
		Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Cow-acre days* [2]
Beach sand	Ba									
Beauford silty clay, 0 to 2 percent slopes	Bb	60	25	45	35	15	14	2. 25	3. 0	170
Blue Earth silty clay loam, 0 to 2 percent slopes	Bc	50	18	40	25	12	10	1. 75		150
Clarion fine sandy loam, 1 to 7 percent slopes	Ca	45	15	40	25	10	8	1. 75	3. 0	150
Clarion fine sandy loam, 8 to 20 percent slopes	Cb			35	20	8	6	1. 50	2. 5	125
Clarion-Lakeville loams, eroded, 8 to 13 percent slopes	Cc	40	12	35	20	9	7	1. 75	2. 5	125
Clarion loam, 8 to 12 percent slopes	Cd	50	17	45	32	10	10	1. 75	3. 0	150
Clarion silt loam, 2 to 7 percent slopes	Ce	60	22	55	35	13	11	2. 00	3. 5	175
Comfrey silty clay loam, 0 to 1 percent slopes	Cf	62	22	45	30	12	14	2. 25		175
Dickinson fine sandy loam, 1 to 7 percent slopes	Da	40	12	40	20	8	7	1. 50	2. 5	110
Dickinson fine sandy loam, 8 to 20 percent slopes	Db			30	15		5	1. 25	2. 0	90
Dickinson loamy fine sand, 1 to 7 percent slopes	Dc	25	8	27	10		4	1. 00	1. 7	80

See footnotes at end of table.

TABLE 3.—*Estimated average acre yields of principal crops on soils of Faribault County, Minn., under recommended management*—Continued

[Blank spaces indicate either that the soil is not planted to the crop named or that the system of management does not include this crop in the rotation]

Soil	Map symbol	Corn	Soybeans	Oats	Barley	Flax	Corn silage	Clover, timothy, and bromegrass	Alfalfa or alfalfa-bromegrass	Rotation pasture [1]
		Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Cow-acre days* [2]
Dickinson loamy fine sand, 8 to 20 percent slopes	Dd			20				.75	1.5	60
Glencoe silty clay loam, 0 to 2 percent slopes	Ga	58	24	50	34	15	14	2.00		175
Guckeen silty clay loam, 1 to 3 percent slopes	Go	65	22	55	35	18	13	2.25	3.5	175
Guckeen silty clay loam, 2 to 7 percent slopes	Gc	65	22	55	35	14	12	2.00	3.5	175
Harpster silty clay loam, 0 to 2 percent slopes	Ha	55	18	40	25	12	10	1.75	2.5	150
Lura silty clay, 0 to 2 percent slopes	La	55	22	45	32	12	13	2.00		170
Marna silty clay loam, 0 to 2 percent slopes	Ma	65	24	50	35	18	13	2.25	3.0	165
Marna silty clay loam, 2 to 5 percent slopes	Mb	65	24	50	35	18	12	2.25	3.0	165
Marsh	Mc									3
Mixed alluvial land	Md									100
Muck	Me	40	18	35	20	11	13	2.00		160
Muck, shallow phase	Mf	45	20	40	23	12	13	2.00		165
Nicollet and Clarion silty clay loams, 1 to 3 percent slopes	Na	65	24	55	38	18	13	2.25	3.5	175
Peat	Pa	40	18	35	20	11	13	2.00		160
Peat, shallow phase	Pb	45	20	40	23	12	13	2.00		165

Storden-Lakeville loams, eroded, 13 to 30 percent slopes	Sa	----	----	30	----	----	----	1. 25	2. 0	100
Storden loam and silt loam, 13 to 30 percent slopes	Sb	----	----	35	----	----	----	1. 50	2. 5	125
Terril loam and silt loam, 1 to 7 percent slopes	Ta	65	24	55	38	13	12	2. 00	3. 5	175
Truman silt loam, 1 to 5 percent slopes	Tb	55	20	55	35	12	10	2. 00	3. 5	175
Truman silt loam, 6 to 12 percent slopes	Tc	50	18	48	30	10	9	1. 75	3. 0	150
Volin silt loam, 0 to 2 percent slopes	Va	65	23	55	38	18	13	2. 25	3. 5	175
Webster silty clay loam, 0 to 2 percent slopes	Wa	65	24	55	38	18	13	2. 25	3. 0	165

[1] Rotation pasture is pasture established as a part of a planned sequence of crops; it is used a few years and followed by a small grain or a row crop.

[2] Cow-acre-days, used to express the carrying capacity of pastureland, is the product of the number of animal units carried per acre multiplied by the number of days they can be grazed without injury to the pasture. For example, a soil that supports 1 animal unit per acre for 360 days rates 360; a soil supporting 1 animal unit on 2 acres for 180 days rates 90; and a soil supporting 1 animal unit on 4 acres for 100 days rates 25.

[3] Permanent pasture.

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TABLE 4.—*Average crop yields in Faribault County, Minn., and possible increases under recommended soil management practices according to estimates made in 1951* [1]

Crop	Crop yield	Estimated increase	Adjusted yields
Corn for grain......bushel..	[2] 41.8	10.8	52.6
Corn for silage......ton	[2] 7.5	2.2	9.7
Soybeans for grain......bushel..	[3] 15.5	3.8	19.3
Sugar beets......ton..	[3] 10.0	2.0	12.0
Sweet corn (canning)......do..	[3] 2.4	.8	3.2
Peas (canning)......do....	[3] .78	.2	.98
Oats......bushel...	38.6	11.0	49.6
Winter wheat......do..	16.4	5.1	21.5
Flax......do....	10.8	3.6	14.4
Alfalfa and bromegrass......ton..	1.5	1.0	2.5
Wild hay......do..	1.0	.5	1.5
Pasture rotation......cow-acre-days..	124	51	175.0
Pasture, open, permanent......do....	60	80	140.0

[1] These data are by the Department of Soils, University of Minnesota, and are based on unpublished material obtained by the Department of Soils in cooperation with the Tennessee Valley Authority.
[2] Adjusted for use of hybrid corn.
[3] Adjusted average from State.

PRINCIPLES OF GOOD SOIL MANAGEMENT

The most important practices of good soil management are:

1. Drainage.
2. Use of good tillage methods.
3. Use of appropriate sequence of crops.
4. Maintenance of organic matter.
5. Application of commercial fertilizer and lime.
6. Control of erosion.
7. Control of weeds.
8. Improvement of pasture.

Information on these practices may be obtained through the county agricultural extension agent or the State agricultural experiment station. These practices are a part of the Minnesota Soil Fertility and Conservation Program (*3*, *4*)[1].

The practices of good management apply in different ways to the different soils. Nevertheless, it is possible to group the soils of Faribault County so that all of the soils in one group will need about the same kind of management. This has been done in table 5, which places the soils in 12 groups and gives suitable crops, crop rotations, and supplemental practices for each group. A discussion of each of the 8 major practices of good management follows. Additional information on management of the individual soils will be found in the section, Soils of Faribault County, Their Use and Management.

Drainage

Adequate drainage is necessary for high yields of the common field crops. A high proportion (58 percent) of the soils of Faribault

[1] Italic numbers in parentheses refer to Literature Cited, p. 71.

TABLE 5.—*Use and management suggestions for the soils of Faribault County, Minn.*

Management group [1] and soil	Most suitable crops [2]	Suitable rotations [3]	Supplemental practices needed
Group 1 (nearly level, poorly and imperfectly drained silty clay loam underlain by limy loam and clay loam): Webster silty clay loam, 0 to 2 percent slopes.	Corn, soybeans, small grain, sugar beets, canning crops, grasses, clover.	4-year: G H C C 5-year: G-H-C-G(SwCl)-C 3-year: G-H-C 5-year: G-H-H-C-C 5-year: G-G-H-H-C	Tile drainage; use of commercial fertilizers and manure according to soil needs and supply available.
Group 2 (nearly level to gently undulating, poorly drained silty clay loam and silty clay underlain by silty clay and clay): Beauford silty clay, 0 to 2 percent slopes. Marna silty clay loam, 0 to 2 percent slopes. Marna silty clay loam, 2 to 5 percent slopes.	Corn, soybeans, small grain, sugar beets, canning crops, grasses, clover.	4-year: G-H-C-C 5-year: G-H-C-G(SwCl)-C 3-year: G-H-C 5-year: G-H-H-C-C 5-year: G-G-H-H-C	Tile drainage; use of commercial fertilizers and manure according to soil needs and supply available.
Group 3 (nearly level, very poorly drained [ponded] silty clay loam and silty clay underlain by silty clay loam and clay): Glencoe silty clay loam, 0 to 2 percent slopes. Lura silty clay, 0 to 2 percent slopes.	Corn, soybeans, small grain, sugar beets, canning crops, grasses, clover.	2 year: G(SwCl)-C 4-year: G-H-C-C 5-year: G-H-C-G(SwCl)-C 3-year: G H C 5-year: G-H-H-C-C 5-year: G-G-H-H-C	Tile drainage with surface inlets; use of commercial fertilizers and manure according to soil needs and available supply.
Group 4 (nearly level, imperfectly drained to very poorly drained, very limy silty clay loam underlain by limy loam and clay loam): Blue Earth silty clay loam, 0 to 2 percent slopes. Harpster silty clay loam, 0 to 2 percent slopes.	Corn, soybeans, sugar beets, small grain, some canning crops, grasses, clover.	4-year: G-H-C-C 5-year: G-H-H-C-C	Tile drainage with surface inlets; use of commercial fertilizers and manure according to soil needs and available supply.

See footnotes at end of table.

TABLE 5.—*Use and management suggestions for the soils of Faribault County, Minn.* Continued

Management group [1] and soil	Most suitable crops [2]	Suitable rotations [3]	Supplemental practices needed
Group 5 (nearly level to gently undulating, imperfectly and moderately well-drained silty clay loam underlain by silty clay and clay): Guckeen silty clay loam, 1 to 3 percent slopes. Guckeen silty clay loam, 2 to 7 percent slopes.	Corn, soybeans, small grain, sugar beets, canning crops, grasses, clover, alfalfa.	4-year: G-H-C-C 5-year: G-H-H-C-C 3-year: G-H-C 6-year: G-H-H-C-G(SwCl)-C 4-year: G-H-H-C 5-year: G-H-H-H-C	Grass waterways; use of commercial fertilizers and manure according to soil needs and available supply.
Group 6 (nearly level to undulating, moderately well-drained and well-drained silt loam and silty clay loam underlain by limy loam and clay loam): Nicollet and Clarion silty clay loams, 1 to 3 percent slopes. Clarion silt loam, 2 to 7 percent slopes. Terril loam and silt loam, 1 to 7 percent slopes. Truman silt loam, 1 to 5 percent slopes. Volin silt loam, 0 to 2 percent slopes.	Corn, soybeans, small grain, sugar beets, canning crops, grasses, clover, alfalfa.	4-year: G-H-C-C 5-year: G-H-H-C-C 3-year: G-H-C 6-year: G-H-H-C-G(SwCl)-C 4-year: G-H-H-C 5-year: G-H-H-H-C	Grass waterways; use of commercial fertilizers and manure according to soil needs and available supply.
Group 7 (undulating to gently rolling, well-drained loams and fine sandy loams underlain by limy loam): Clarion fine sandy loam, 1 to 7 percent slopes. Clarion loam, 8 to 12 percent slopes. Clarion-Lakeville loams, eroded, 8 to 13 percent slopes.	Corn, soybeans, small grain, grasses, clover, alfalfa.	5-year: G-H-H-H-C 4-year: G-H-H-H	Contour tillage of uniform slopes; grass waterways; use of commercial fertilizers and manure according to soil needs and available supply.

Truman silt loam, 6 to 12 percent slopes.			
Group 8 (undulating and gently rolling, excessively drained sandy loams): Dickinson fine sandy loam, 1 to 7 percent slopes. Dickinson loamy fine sand, 1 to 7 percent slopes.	Corn, soybeans, small grain, canning crops, grasses, clover, alfalfa.	5-year: G H–H–H–C 4-year: G H–H–H	Wind stripcropping; grass waterways; use of commercial fertilizers and manure according to soil needs and available supply.
Group 9 (hilly, excessively drained soils): Clarion fine sandy loam, 8 to 20 percent slopes. Dickinson fine sandy loam, 8 to 20 percent slopes. Dickinson loamy fine sand, 8 to 20 percent slopes. Storden-Lakeville loams, eroded, 13 to 30 percent slopes. Storden loam and silt loam, 13 to 30 percent slopes.	Corn, oats, grasses, clover, alfalfa.	4-year: G–H–H–H Hay or pasture	Grass waterways; pasture renovation and management; use of commercial fertilizer according to soil needs and available supply.
Group 10 (poorly drained soil of the flood plain): Comfrey silty clay loam, 0 to 1 percent slopes.	Corn, small grain, hay, pasture, grasses, clover.	4-year: G(SwCl)–C–C–G 2-year: G(SwCl) C 4-year: G–H–C–C Hay or pasture	Diking where feasible; drainage; use of commercial fertilizers according to soil needs and available supply.
Group 11 (organic soils): Muck. Muck, shallow phase. Peat. Peat, shallow phase.	Pasture, hay, corn, corn silage, clover, truck crops, soybeans, grasses.	4-year: G–H–C–C 5-year: G–H–H–C–C 3-year: G–H C Hay or pasture	Drainage; rolling; wind stripcropping on large areas.
Group 12 (miscellaneous land types): Mixed alluvial land. Beach sand. Marsh.	Pasture and wildlife		Same.

[1] Groups 1, 2, 3, 4, 10, and 11 require artificial drainage for rotations suggested.
[2] The important canning crops at the time of the survey were peas and sweet corn. Grasses are mainly timothy and clover.
[3] Letters in rotation: C=intertilled crops (corn, soybeans, sugar beets, or other root crops); G=oats, barley, wheat, rye, flax; H=hay (timothy and clover or alfalfa and bromegrass); G(SwCl)=grain seeded to sweetclover to be plowed under for green manure.

Figure 6. **This recently plowed broad-base drainage ditch in Webster silty clay loam, 0 to 2 percent slopes, can be crossed with farm machinery.**

County, or those in management groups 1 through 4 and in groups 10 and 11, require some kind of artificial drainage for general farm crops. Most of these soils are fertile and can be made into productive cropland if artificially drained. The increased returns resulting from installation of an adequate drainage system vary according to the soil and the management following installation. Whether these returns will compensate over a period of years for the cost of the drainage system depends on many factors, among which are the cost of installation and the prices received for farm products. An immediate gain, however, may be realized in the increased value of the land.

Each farm having soils that require drainage has an individual problem that usually requires study by a competent drainage engineer. Tile is generally but not necessarily used in small drainage areas (less than 300 acres). Spacing and size of the tiles in any drainage system depend upon the soil type and the size of the watershed. The two most important soil characteristics determining tile spacing are texture and quantity of organic matter in the soil. In larger drainage areas, it may be more economical to use open ditches (fig. 6). Outlet ditches should be 1 foot deeper than tile outlets on all of the soils except the Peats and Mucks; for these soils, ditches should be still deeper.

It is estimated that tile placed at depths of 3½ to 4 feet should be spaced about 6 or 7 rods apart in the soils of groups 1 and 4 and in Glencoe silty clay loam, 0 to 2 percent slopes, of group 3. They should be closer together in the soils of group 2 and in Lura silty clay, 0 to 2 percent slopes, of group 3. The minimum size of tile recommended is 6 inches in diameter. Care must be taken to insure adequate outlets for drainage on Comfrey silty clay loam, 0 to 1 percent slopes, of group 10. The overflow hazard on this soil must also be taken into consideration.

Open ditches are common in Peats and Mucks, group 11; but if drainage tile is used, lines can be placed about 8 rods apart. Concrete draintile is generally not recommended for these organic soils.

During wet seasons the Guckeen soils of group 5 need drainage, and during very wet seasons Nicollet and Clarion silty clay loams, 1 to 3 percent slopes, and Volin silt loam, 0 to 2 percent slopes, of group 6 may be benefited by artificial drainage. The increased yields and profits realized during these seasons, however, may not offset the initial investment of drainage installation. Other soils of group 6 and those of groups 7, 8, and 9 have no drainage problem.

Good Tillage Methods

Tillage usually encourages soil aeration, helps incorporate crop residues and manure, and conserves moisture; and it is a means of providing the satisfactory seedbeds so essential for good stands.

Fine-textured soils, groups 2, 3, and 5 (table 5), are likely to puddle if tilled when wet and the tilth may be ruined for a year or more. These soils should be plowed in the fall, and when they have the proper moisture content. Any clods formed will be broken down during the winter and the tilth will normally be in excellent condition the following spring. Fall plowing also saves valuable time by eliminating a step in the preparation of seedbeds during the busy spring planting season.

Soils of groups 7, 8, and 9 should not be plowed in the fall because of their susceptibility to erosion. Crop residues should remain on the surface until spring to give protection against erosion. The soils of these groups on undulating or steeper slopes should be plowed and cultivated as nearly crosswise of the slopes as possible. This practice, contour cultivation, will conserve moisture in the soil by increasing infiltration of water, and will prevent loss of valuable surface soil by retarding runoff. Since most of these soils are on rather irregular slopes, this practice may be difficult to follow.

Sequence of Crops

It has long been recognized that alternate crops of corn and oats yield better than either crop grown continuously. Planting a soil to corn year after year usually results in a lower organic-matter and plant-nutrient content and a deterioration of soil structure that causes the soil to puddle, or run together, when wet and to bake when dry. Such losses can be controlled by growing small-grain crops and grasses and legumes in the rotation.

A well-planned crop rotation adapted to most soils and to the climatic conditions in Faribault County includes not only an intertilled crop and a small grain but also mixed grasses and legumes. Legumes furnish nitrogen and organic matter; and the grass and legume sods prevent soil washing and improve soil tilth. A crop rotation is the basis for the control of weeds, insect pests, and plant diseases. Moreover, it permits the distribution of the labor load and reduces the chance of complete loss from a single crop failure. A rotation plan is simplified if the farm has the same number of approximately equal-sized fields as there are years in the rotation, and continuation of the rotation is provided for in case the grass-and-legume seeding fails.

Crop rotation studies at the University of Minnesota Agricultural Experiment Station (1910–39) are shown in table 6. The increases shown in this table are about what can be expected from rotations for most soils of Faribault County. The intensity with which the different soils can be cultivated varies greatly. For example, nearly level fertile soils, groups 1 through 4, can tolerate rotations with a high proportion of intertilled crops; whereas on the steeper, shallower soils of group 7, a year of intertilled crops should be balanced by about 2 or 3 years of hay crops. Suggested rotation systems for the different soil groups are given in table 5. The rotations under which maintenance of soil fertility and productivity is the most difficult are listed first.

TABLE 6.—*Crop rotation studies at University Farm, St. Paul, Minn., 1910–39, showing average yield per acre of crops grown in various rotations* [1]

Rotation	Corn	Oats	Wheat	Mixed hay
	Bu.	*Bu.*	*Bu.*	*Ton*
Continuous	36. 6	48. 4	17. 0	
Corn-small grain	40. 2	62. 7	18. 4	
Corn-small grain-mixed hay	46. 1	66. 6	25. 2	2. 18
Corn-oats-wheat-mixed hay	48. 5	65. 6	24. 3	2. 54
Corn-oats-wheat-mixed hay-pasture	49. 7	64. 5	23. 6	2. 32

[1] Soil treatment: Manure used at the rate of approximately 2 tons per acre per year on all plots. Data from Minn. Agr. Ext. Serv. Bul. 149.

Maintenance of Organic Matter

Organic matter is one of the most important constituents of a fertile soil. The very dark soils that predominate in this county are considered fertile. If they are not productive at present, they can be made so by providing adequate drainage, supplying additional organic matter, and adding needed plant nutrients. The cheapest and most efficient means of adding organic matter is the turning under of crop residues and farm manure.

Benefits from maintaining or increasing the organic-matter content of the soil are as follows: (1) Increased soil fertility, (2) increased plant-nutrient availability, (3) stimulated growth of soil bacteria, (4) increased effectiveness of commercial fertilizer, (5) increased moisture-holding capacity, (6) maintenance of good tilth, (7) increased aeration, and (8) basic control of wind and water erosion.

Grassland vegetation and climatic conditions have combined to bring about an accumulation of large quantities of organic matter in most of the soils in the county. After the rich Prairie soils and the poorly drained soils of this county are first brought under cultivation, their organic-matter content decreases rapidly. It is not, however, economically feasible to maintain as high a reserve of organic matter as under the native grasses. The level for safe and economical production appears to be about 60 percent of the organic matter originally present.

Intertilled cropping that necessitates frequent cultivation slowly burns up the supply of organic matter, whereas the growing of legumes and grasses for hay and pasture adds to the supply. Because barnyard manure is a good source of organic matter, it is recommended that at least one application of about 8 tons an acre be made before the cultivated crop during the course of each rotation. Applications of manure to fields that are seeded to legumes and grasses in a nurse crop of small grain will help to insure a good stand of the legumes.

A ton of average fresh farm manure contains about 10 pounds of nitrogen, 5 pounds of phosphate, and 10 pounds of potash in forms that soon become available to plants. To retain these plant nutrients, manure must be properly handled from the time it is produced until it is spread on the soil. Maximum return is obtained by spreading it daily or frequently on land that is not rolling or subject to soil erosion. Since the supply of phosphorus in manure is limited, it is advisable to add to each ton about 10 pounds of 45-percent superphosphate fertilizer.

Where there is a shortage of barnyard manure, as on most farms, green manure should be provided in the rotation system. Deep-rooted legumes, such as sweetclover, improve not only the soil tilth but also the internal drainage. They are recommended for the very fine-textured, sticky, poorly drained soils of groups 2, 3, and 5. The most badly rundown fields of groups 7 and 9, which require preparation before the regular rotation, should have applications of barnyard manure, and a green-manure crop such as sweetclover should be grown on them. The use of winter rye as a cover crop and green-manure crop is recommended for the sandy soils of group 8.

Application of Commercial Fertilizer and Lime

Crops differ in their need for certain fertilizers in much the same way that soils differ in their capacity to supply available plant nutrients. Nutrients are continually being taken out of the soil by crops. In addition to farm manure and crop residues, commercial fertilizers are a source of essential plant nutrients. They are the greatest single means of adding plant nutrients to soils of low fertility. Fertilizers differ considerably in their percentages of nitrogen, phosphoric acid, and potash. One expressed as 3–18–9 contains the equivalent of 3 pounds nitrogen, 18 pounds phosphoric acid, and 9 pounds of potash in each 100 pounds of fertilizer (*11*).

Experiments show that yields significantly increase when phosphate fertilizer is added to Clarion and Webster soils (*4*). Alfalfa yields were increased by 0.85 ton per acre, alfalfa-bromegrass by 1.30 tons, and corn by 5.3 bushels. All phosphate applications were added to the small grain crop, which was seeded as a nurse crop with a legume or a legume-grass mixture.

Available phosphate content is too low for maximum crop production in many soils in Faribault County, particularly in the dark, fine-textured, imperfectly or poorly drained soils of groups 1 through 5.

In general, nitrogen is most economically supplied by growing inoculated legumes and by applying barnyard manure. Additional nitrogen is often needed, however, as a topdressing for oats and wheat or as a sidedressing for corn.

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Potassium is most likely to be deficient in very limy and poorly drained soils such as Blue Earth silty clay loam, 0 to 2 percent slopes, and Harpster silty clay loam, 0 to 2 percent slopes, and in sandy soils of group 8.

To determine fertilizer needs of the soils on a farm, it is recommended that soil samples be sent to the Soil Testing Laboratory, University Farm, St. Paul, Minn., for analyses and recommendations. Of the 142 samples of surface soil submitted by farmers of Faribault County and tested at the Soil Testing Laboratory through 1951, 34.8 percent were low in phosphate, 35.7 percent medium, and 29.5 percent high; 25.0 percent were low in potash, 37.9 percent medium, and 37.1 percent high. Another means of determining the fertilizer needs is to fertilize strips 2 or 3 rods wide laid across the field and observe the crop response in these strips.

Faribault County soils are well supplied with lime; and two of them, Blue Earth silty clay loam, 0 to 2 percent slopes, and Harpster silty clay loam, 0 to 2 percent slopes, are calcareous at the surface. Lime needs are determined by the total acidity of the soil. Limited acidity tests indicate that alfalfa and sweetclover might be benefited in some areas of the county by an application of lime. No field trials have been made in the county.

Erosion Control

Erosion-control programs are based on good farming practices. Examples of such practices are (1) proper soil use, (2) improved crop rotations that include inoculated legumes and grasses, (3) maintenance of organic matter and use of fertilizers, (4) good tillage methods, and (5) pasture improvement and better grazing methods. It is thus possible to encourage and maintain high yields and at the same time conserve the soil and control erosion. Certain mechanical practices relating directly to erosion control should also be employed. Contour farming and contour stripcropping to prevent excessive soil washing should be practiced on long and uniform slopes. In contour farming, the slopes are cultivated crosswise to the direction of the slope. The field operations and crop rows are therefore approximately at right angles to the direction of the flow of surface water. In stripcropping, the fields are not plowed or cultivated in their entirety, but in contour strips separated by bands of soil-holding crops such as legume-grass sod mixtures. Terraces to break the flow of runoff water from the long sloping fields are advisable where the slopes are uniform and of less than 12 percent.

The establishment and maintenance of good sod in natural waterways, especially for soils of groups 6, 7, 8, and 9, is one of the most effective means of eliminating field gullies. These waterways will also provide meadows that can be harvested for hay. It is important that the grassed waterways be wide enough to prevent gullying on the sides (fig. 7).

Badly eroded fields on the hilly, excessively drained soils (group 9) are not suited to continuous cultivation and most of them have deteriorated through erosion and leaching of nutrients (fig. 8). Over a period of years, these areas provide better returns if they are con-

Figure 7.—**Broad sodded waterway on Clarion loam, 8 to 12 percent slopes.**

verted to permanent meadow or pasture and managed as recommended under the heading, Pasture Improvement.

Sandy soils of group 8 are subject to wind erosion. Cultivation that leaves the surface rough, proper seedbed preparation, field stripcropping, and leaving crop residue near the surface are necessary conservation practices. Such implements as the field cultivator,

Figure 8.—**Sheet and gully erosion on Storden loam and silt loam, 13 to 30 percent slopes. Material deposited at foot of slope partly covers the area of Webster silty clay loam, 0 to 2 percent slopes, in foreground.**

duckfoot cultivator, press drill, and subsurface packer are recommended. In large open fields, 2 or 3 rows of corn can be planted every 4 rods and left standing during winter to hold snow cover and check soil drifting.

Weed Control

The most common noxious weed reported for Faribault County is the Canada thistle (*Cirsium arvense*), followed by sowthistle (*Sonchus arvensis*) and cocklebur (*Xanthium italicum*). Cocklebur is spread by combines in soybean fields, and it has increased rapidly as a result of greater soybean acreages during the last 5 or 10 years. Sugar-beet fields have become weedy during the past years. Only three fields of creeping jenny or field bindweed (*Convolvulus arvensis*) were reported in the county at the time of survey.

The best way to control weeds is to use a good crop rotation. Other methods of weed control recommended include (1) fallowing, or fallowing in combination with winter wheat or rye or with summer hay crops; (2) clean cultivation; (3) use of clean seed; (4) pasturing or cutting weeds before they mature seed; and (5) the use of chemical weed killers under critical conditions.

Infestation by Canada thistle can be controlled by growing alfalfa (*Medicago sativa*). Small infestations of any weed can be controlled by chemicals. Creeping jenny can be eliminated chemically or by fallowing.

The county agent should be consulted for the most up-to-date information on use of chemicals for weed control.

Pasture Improvement

In Faribault County grazing should begin about the middle of May on permanent bluegrass pasture (*Poa pratensis*), or when the grass is 3 to 4 inches high. From then until about July 10, when bluegrass makes most of its growth, the pasture should be grazed intensively. From July 10 through the first part of September other pasture should be provided. Some fall grazing may be obtained on the permanent pasture. Supplemental pasture in midsummer can best be provided by grazing the second growth of legume-grass meadows. This should be considered in the preparation of any farm plan. Sudangrass sown at the rate of 25 to 30 pounds an acre in late May will also provide midsummer pasture. Annual weeds can be controlled by mowing before they go to seed. Topdressing pastures every 4 or 5 years with about 6 loads of manure an acre has proved to be an excellent practice.

Rotation pasture may give far greater returns than permanent pasture. Since most soils in this county are deep, moderately free of stones, and not too steep to permit plowing, unproductive pastures should be plowed under, and a good seedbed prepared. The soil should then be used in a rotation of crops and pasture or, if highly susceptible to erosion, seeded to a good pasture mixture.

More specific instructions on how to renovate pasture may be obtained from the county agricultural agent.

SOILS OF FARIBAULT COUNTY, THEIR USE AND MANAGEMENT

The soils of Faribault County have been placed in the broad Clarion and Webster soil association, which covers a region in south-central Minnesota and north-central and central Iowa (*10*). The soils are described by type, phase, or miscellaneous land type. The soil descriptions include occurrence with respect to other soils of the county, distribution, slope, drainage, erosion, profile description, productivity, present use, and special problems of use and management. Location and distribution of the soils are shown on the soil map that accompanies this report, and the approximate acreage and proportionate extent are given in table 7.

TABLE 7.—*Approximate acreage and proportionate extent of the soils mapped in Faribault County, Minn.*[1]

Map symbol	Soil	Acres	Percent
Ba	Beach sand	1, 700	0. 37
Bb	Beauford silty clay, 0 to 2 percent slopes	7, 300	1. 61
Bc	Blue Earth silty clay loam, 0 to 2 percent slopes	7, 700	1. 69
Ca	Clarion fine sandy loam, 1 to 7 percent slopes	1, 550	. 34
Cb	Clarion fine sandy loam, 8 to 20 percent slopes	575	. 13
Cc	Clarion-Lakeville loams, eroded, 8 to 13 percent slopes	1, 100	. 24
Cd	Clarion loam, 8 to 12 percent slopes	19, 000	4. 16
Ce	Clarion silt loam, 2 to 7 percent slopes	52, 800	11. 6
Cf	Comfrey silty clay loam, 0 to 1 percent slopes	12, 300	2. 70
Da	Dickinson fine sandy loam, 1 to 7 percent slopes	5, 100	1. 12
Db	Dickinson fine sandy loam, 8 to 20 percent slopes	500	. 11
Dc	Dickinson loamy fine sand, 1 to 7 percent slopes	1, 500	. 33
Dd	Dickinson loamy fine sand, 8 to 20 percent slopes	350	. 08
Ga	Glencoe silty clay loam, 0 to 2 percent slopes	5, 300	1. 17
Gb	Guckeen silty clay loam, 1 to 3 percent slopes	18, 200	3. 97
Gc	Guckeen silty clay loam, 2 to 7 percent slopes	5, 400	1. 18
Ha	Harpster silty clay loam, 0 to 2 percent slopes	53, 400	11. 7
La	Lura silty clay, 0 to 2 percent slopes	17, 900	3. 93
Ma	Marna silty clay loam, 0 to 2 percent slopes	61, 500	13. 5
Mb	Marna silty clay loam, 2 to 5 percent slopes	4, 300	. 94
Mc	Marsh	4, 100	. 90
Md	Mixed alluvial land	3, 800	. 83
Me	Muck	1, 350	. 28
Mf	Muck, shallow phase	1, 900	. 42
Na	Nicollet and Clarion silty clay loams, 1 to 3 percent slopes	48, 400	10. 6
Pa	Peat	7, 000	1. 54
Pb	Peat, shallow phase	5, 700	1. 25
Sa	Storden-Lakeville loams, eroded, 13 to 30 percent slopes	475	. 10
Sb	Storden loam and silt loam, 13 to 30 percent slopes	4, 100	. 90
Ta	Terril loam and silt loam, 1 to 7 percent slopes	1, 900	. 42
Tb	Truman silt loam, 1 to 5 percent slopes	6, 500	1. 43
Tc	Truman silt loam, 6 to 12 percent slopes	8, 400	1. 84
Va	Volin silt loam, 0 to 2 percent slopes	4, 700	1. 06
Wa	Webster silty clay loam, 0 to 2 percent slopes	80, 300	17. 6
	Total	456, 300	100. 0

[1] Water covers about 1.5 percent of the acreage in the county.

Beach sand (Ba)

Beach sand consists of loose sandy soil materials confined to shorelines of lakes or of former lakes that have recently dried up or have been artificially drained. Most areas are associated with Blue Earth silty clay loam, 0 to 2 percent slopes, and with Peat and Muck, which occupy the more depressed parts of the former lake basins. A few areas of beach sand too small to map separately are included with Blue Earth silty clay loam, 0 to 2 percent slopes. Slopes commonly range from 1 to 2 percent, but a few that lie above morainic shorelines exceed 3 percent.

Profile description:

0 to 15 inches, loose loamy fine sand containing mixtures of well to poorly decomposed organic matter.
15 to 20 inches, generally gray, highly calcareous, loose, medium and fine sand with a few fine mottles of rust brown.
20 inches +, gray calcareous fine sand.

Variation from this generalized profile occurs from place to place and within short distances. In places, the surface soil and subsoil are gray highly calcareous fine sandy loam containing large quantities of shell lime. The surface soil may change abruptly to a dark-brown sandy loam, which grades into a brown and yellowish-brown sandy loam subsoil. The subsoil, in turn, may overlie gray or olive-gray calcareous fine sand. Clay loam glacial till or silty clay lake sediments generally are not present at depths of less than 4 feet. Few stones occur on or in the surface layer, but some gravel and stones may be present in the lower part. During wet periods drainage is restricted by a water table where this land type grades into Blue Earth silty clay loam, 0 to 2 percent slopes.

Use and management.—When the survey was made, much of this land type was idle and covered with annual weeds, native grasses or shrubs, and a few trees. It had a low plant-nutrient content and a low water-holding capacity.

The soil is subject to drifting and in spots contains lime in quantities injurious to crops. Areas of this land type in larger fields of more productive soils have been used for crops with varied but usually discouraging results. It may be necessary to cultivate small included areas, but fields made up mostly of Beach sand are best used for pasture.

Beauford soil

Beauford silty clay, 0 to 2 percent slopes (Bb)

This fine-textured, deep, dark-colored, poorly drained soil has developed on clayey sediments that were deposited in shallow glacial lakes, ponds, and sluggish drainageways. It occurs in association with the more poorly drained Lura soil. It is generally in the northern half of the county; large tracts may be found in section 1 of Lura Township. This soil is like the Marna, but its parent material consists of lake sediments that contain more clay that is free of gritty material.

Profile description:

0 to 19 inches, black to very dark-gray coarse granular silty clay; aggregates firm when moist and sticky when wet; color grades to very dark brown in the lower part of this layer; slightly acid.

19 to 32 inches, dark grayish-brown fine subangular blocky clay; aggregates very firm when moist and very plastic when wet; medium acid.

32 to 38 inches, olive-gray silty clay of fine subangular blocky structure; aggregates waxy and very firm when moist and very plastic when wet; medium acid.

38 to 46 inches, pale-olive silty clay of subangular blocky structure; aggregates very firm when moist and plastic when wet; medium acid.

46 to 55 inches, pale-olive massive silty clay loam with medium mottles of yellowish brown and dark brown; neutral.

55 inches +, mottled light olive-gray and yellowish-brown highly calcareous silty clay; contains many lime concretions and iron stains; parent material free of pebbles.

Variations in profile characteristics are in the depth of the dark-colored surface layer, which ranges from 12 to 20 inches. In several places gypsum crystals are abundant in the subsoil, and in a few places there may be clay till.

Use and management.—At the time of the survey these soils had been drained and were being cropped heavily to corn and soybeans. The highest yields of corn, up to 70 bushels an acre, were obtained during dry years. This crop suffers from excessive moisture during wet seasons, when yields may be as low as 40 bushels an acre.

A typical crop sequence is as follows: Field corn, sweetcorn, sugar beets, and corn followed by soybeans. Soybeans are generally planted in years when it is impossible to prepare the seedbed before the middle of June. Generally only one field is kept in hay on each farm. This cropping plan is not recommended, because under it a field is not likely to be seeded to grasses and legumes more often than once in 30 years.

Providing adequate drainage and good tilth is of major importance in maintaining high productivity. Drainage is best obtained by removing excess surface water through shallow ditches and by tile. Tile lines must be 3½ to 4 feet deep and must be placed about 50 feet apart to assure adequate drainage of this very clayey soil.

Legumes such as sweetclover, plowed under, and grasses in the rotation will improve tilth and increase permeability. Fertilizer requirements should be determined by soil tests. Beauford silty clay, 0 to 2 percent slopes, is in management group 2 of table 5.

Blue Earth soil

Blue Earth silty clay loam, 0 to 2 percent slopes (Bc)

Blue Earth silty clay loam, 0 to 2 percent slopes, usually occupies small, nearly level basins of former small glacial lakes and ponds, most of which have been artificially drained and are dry the greater part of the year. This soil may also occupy the outer rims of peat- and muck-filled basins. It is found throughout the county. The largest single tract occupies the bottom of former Lake Ozatanka, but the greatest concentration is in Kiester Township.

Profile description:

0 to 15 inches, dark brownish-gray and very dark-gray (gray when dry) friable, highly calcareous, silty clay loam slightly mottled with light brownish gray; the well-defined fine granules high in organic matter give layer some fluffiness; shell lime generally present on or below the surface; crayfish mounds and chimneys common; mildly alkaline.

15 to 24 inches, dark-gray, grading to gray with increasing depth, calcareous silty clay loam with faint coarse pale-yellow and light-olive mottles; friable to firm when moist but plastic when wet; mildly alkaline.
24 inches +, light yellowish-brown highly calcareous clay loam mottled with light gray and containing many rust concretions.

The principal variations in the surface soil are in the texture and color. This layer grades to a silt loam and ranges from 15 to 24 inches in thickness. Exceedingly calcareous shallow mucks are included with this soil.

Use and management.—At the time of the survey this soil was being used for such crops as flax, corn, and soybeans, and to a lesser extent for sugar beets. Some areas were still in meadow and pasture; the soil is well adapted to this use in its natural state. Even when this soil is artificially drained, the drainage system is not adequate during periods of heavy rains because surface runoff flows into the depressed positions from surrounding areas. For instance, the cloudburst during the night of July 4, 1947, drowned out the corn and sugar beet crops in the basin of the former Lake Ozatanka. The soil dried up very rapidly, however, after the floodwater receded, and the fields were reworked and replanted in time to produce a crop of soybeans.

During drier seasons yields of corn have been high, but corn planted late is frequently injured by early frosts.

Soybeans frequently show symptoms of mineral-nutrient deficiency, notably iron. This is evidenced by the yellowing between the veins of young leaves and the death of many older leaves. Symptoms of phosphorus and potassium deficiencies may also appear. Phosphorus deficiency is shown by many brown spots on older leaves, and potassium deficiency by stunted growth and yellowing at the margin of leaves and by browning and crinkling of leaf tissue. Spraying with a 2-percent solution of iron (ferrous) sulfate is recommended for remedying the iron deficiency. The amount of phosphate and potash should be determined by soil tests.

Clarion soils

The Clarion are dark well-drained Prairie soils developed on medium-textured, calcareous glacial till. They dominate the undulating to rolling uplands that have slopes of 1 to 20 percent (fig. 3). They occur throughout the county, more commonly in the southern half. The soils are:

Clarion fine sandy loam, 1 to 7 percent slopes.
Clarion fine sandy loam, 8 to 20 percent slopes.
Clarion loam, 8 to 12 percent slopes.
Clarion silt loam, 2 to 7 percent slopes.

In addition, the Clarion soils are major components of the Clarion-Lakeville loams and minor components of the Nicollet and Clarion silty clay loams.

Representative profile (Clarion silt loam):

0 to 11 inches, very dark grayish-brown, almost black when wet, friable granular silt loam.
11 to 19 inches, dark grayish-brown, fading to grayish-brown, slightly finer and less friable silt loam; slightly acid.
19 to 30 inches, yellowish-brown, friable loam to light clay loam having many channels and spots of dark brown and dark yellowish brown.

30 inches +, yellowish-brown and light yellowish-brown friable calcareous loam till containing many small pieces of limestone and granitic pebbles. This parent material is from the Mankato substage of the Wisconsin glaciation.

Variation in the profile characteristics are in texture and thickness of the layers and in depth to limy till, which ranges from 24 to 36 inches. Included are soils with pockets of sandy and gravelly materials that are embedded in the lower part.

At the time of the survey, cropping practices on these soils centered about the growing of corn, small grains, and hay. Corn was the principal cultivated crop, but during recent years soybeans have become an important cash crop. Nearly all of the Clarion soils are under cultivation.

These naturally well-drained soils do not need artificial drainage to produce crops. As they are fairly deep and friable throughout, easy cultivation and rapid root penetration are possible. Their medium texture and high organic-matter content give them a water-holding capacity sufficient to produce high yields in normal seasons. These soils are particularly well adapted to alfalfa and the common clovers. Although the surface soil is acid, it has in most cases enough lime for all crops because the subsoil is amply supplied.

Although some farmers do not follow a planned cropping system on these soils, nearly half of the fields used for small grains are at some time seeded to legumes. A crop rotation system that includes a legume-and-grass crop, such as alfalfa and bromegrass, is necessary to maintain the supply of organic matter. On many farms where these soils predominate, not enough acreage is used for alfalfa and grasses.

Clarion fine sandy loam, 1 to 7 percent slopes (Ca)

Clarion fine sandy loam, 1 to 7 percent slopes, occurs in small areas. Although scattered throughout the county, it is mainly in the southern part.

The soil profile is similar to that described for Clarion silt loam. The main differences are the coarser texture and lighter color of the surface soil.

Use and management.—This phase usually occupies a small part of fields made up of other Clarion soils. It is farmed in the same manner as the adjacent soils. Suggested rotations, fertilization, and supporting conservation practices are given in table 5, management group 7.

Clarion fine sandy loam, 8 to 20 percent slopes (Cb)

Clarion fine sandy loam, 8 to 20 percent slopes, occupies small areas in the southeastern and southwestern parts of the county in close association with the Clarion fine sandy loam, 1 to 7 percent slopes. The profile, however, differs in being shallower.

Use and management.—Because of its steeper slopes, this soil has not been farmed so intensively as Clarion fine sandy loam, 1 to 7 percent slopes. It is poorly suited to cultivation and erodes badly when used for corn or soybeans. This soil is best adapted to hay and small grains and generally provides highest net returns when used for

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hay or pasture. Crop rotations and supplemental management practices are recommended in table 5, management group 9.

Clarion-Lakeville loams, eroded, 8 to 13 percent slopes (Cc)

Clarion-Lakeville loams, eroded, 8 to 13 percent slopes, is an association of Clarion, Lakeville, and Storden soils so closely intermingled in an intricate pattern that it is difficult to separate them on a soil map. This complex is mostly in the southeastern part of the county but it also occurs on slopes along the Blue Earth River.

The proportion of each soil in this complex varies from place to place. Generally, however, the Clarion soils constitute about 60 percent of the total area of the complex, Lakeville 25 percent, and Storden 15 percent. Although the loam type predominates, there is a wide variation in the texture of the surface soil, subsurface layer, and subsoil from place to place. In some spots loose calcareous

Figure 9.—Light-colored calcareous drift at or near the surface creates an intricate pattern of "bald" spots on recently plowed field consisting of Clarion-Lakeville loams, eroded, 8 to 13 percent slopes, Storden-Lakeville loams, eroded, 13 to 30 percent slopes, and other Storden soils; Clarion silt loam in the foreground.

gravelly drift and in others highly calcareous loam or clay loam till occur at or very near the surface. These mixed spots impart a variegated appearance to recently plowed fields (fig. 9). The high knolls and upland ridges are gravelly and light colored, whereas lower slopes are less gravelly and darker colored.

The profile of the Clarion loam in this complex is similar to that described for Clarion soils. It differs, however, in depth to calcareous parent material, which ranges from 20 to 30 inches. It has a browner and thinner surface soil and a more yellowish and lighter brown subsurface layer.

The Lakeville loam differs from the Clarion and Storden in having been developed on loose, sandy, gravelly, and stony calcareous drift.

In addition this soil is more porous and contains more sand, gravel, and cobbles, and larger stones and less clay. It generally occupies gravelly knobs, hummocks, and ridges and is intricately mixed with the Clarion and Storden soils on morainic hills.

A profile description of Lakeville loam follows:

0 to 7 inches, dark grayish-brown and dark-brown very friable, granular loam; slightly acid.

7 to 23 inches, dark-brown friable loam that grades at depths of 2 to 3 inches to brown; slightly more coherent than layer above; slightly acid.

23 inches +, loose calcareous gravelly stony drift consisting of light yellowish-brown mixtures of sand, gravel, and stones.

A type with a gravelly sandy loam surface soil and subsoil is the principal inclusion.

A description of Storden soils in this complex may be found under Storden loam and silt loam, 13 to 30 percent slopes.

Use and management.—It was estimated at the time of the survey that two-thirds of this unit was under cultivation. The remaining areas were for the most part in meadow and pasture. Crop yields varied considerably and depended mainly upon management. The most successful farmers used some form of crop rotation that put a considerable acreage in alfalfa.

Many of the well-drained to excessively drained soils of this complex have eroded badly because of the intensive cropping of their steeper slopes and the overgrazing of many pastures. Deep gullies are present in some of the Lakeville areas. To prevent further deterioration of these soils, intensive cropping should be abandoned and conservation practices should be adopted. The fertility level can be maintained by planting more grasses and legumes in the rotation; by applying organic matter such as barnyard manure; by plowing under crop residues; and by adding mineral fertilizers. Suggested rotations are given in table 5 under management group 7.

Clarion loam, 8 to 12 percent slopes (Cd)

Clarion loam, 8 to 12 percent slopes, is widely distributed over the county. It occurs most frequently in the southeastern part, where the land is more rolling and there is a preponderance of coarser textured soils such as those of the Dickinson series. A few areas too small to map are included with the Storden soils.

The profile is similar to that described for Clarion soils but it differs in being shallower and slightly coarser textured, lighter colored, and better drained. It is more eroded than the previously described Clarion soils.

Use and management.—At the time of the survey most of Clarion loam, 8 to 12 percent slopes, was used for crops, although it was not farmed so intensively as Clarion silt loam, 2 to 7 percent slopes. More hay in proportion to corn and soybeans was grown. This soil is highly productive but care must be taken to control erosion. Much of the surface soil has already been lost by erosion, and gullies have started in a few fields. Fertility maintenance and prevention of erosion are more difficult than for Clarion soils on less steep slopes. Suitable rotations are given in table 5 under management group 7.

Clarion silt loam, 2 to 7 percent slopes (Ce)

Clarion silt loam, 2 to 7 percent slopes, is widely distributed over the county. It is associated with the Webster soil on lesser slopes of the till plain and with the Storden soils and other phases of the Clarion soils on steeper slopes. The profile described under the heading Clarion Soils is characteristic of this phase.

Use and management.—This is one of the best agricultural soils in the county. Nearly every acre is cultivated. Although the soil is not highly susceptible to erosion, some sheet erosion is noticeable on many fields because of the frequent use of corn and other intertilled crops in the cropping sequence. At the time of the survey an estimated 40 percent of the cropland was in corn or other intertilled crops such as soybeans or sugar beets. Most of the rest was in small grains; very little was in grasses or legumes.

The control of erosion on this soil is not difficult. A cropping system that includes a crop of mixed grasses and legumes once in about every 3 years, together with liberal applications of fertilizer, should control erosion. Specific management practices are suggested in table 5 under management group 6.

Comfrey soil

Comfrey silty clay loam, 0 to 1 percent slopes (Cf)

Comfrey silty clay loam, 0 to 1 percent slopes, is a dark-colored poorly drained soil of the alluvial bottom land in the flood plains of larger streams, chiefly the Blue Earth River. It occupies a slightly higher position than the adjacent Mixed alluvial land bordering the channels, but it is subject to periodic flooding, particularly in the early spring. Surface and internal drainage are restricted.

Profile description:

0 to 16 inches, black and dark-gray granular silty clay loam, high in organic matter; firm when moist, slightly sticky when wet; neutral to mildly alkaline.

16 to 28 inches, dark-gray granular silty clay loam, high in organic matter; firm when moist, plastic when wet; neutral to mildly alkaline.

28 to 38 inches, gray and dark-gray silty clay loam mottled in places with olive gray and yellowish brown; firm when moist, plastic when wet; breaks into clods when disturbed; neutral.

38 inches +, gray slightly calcareous silty clay loam spotted with dark brown.

The principal variations are in thickness of the dark-colored surface soil and in the depth to limy materials.

Use and management.—At the time of the survey many areas of this soil were under cultivation and used mainly for corn. It is one of the most productive corn soils in the county. Some fields have produced high yields of corn for more than 10 successive years. Summer floods, however, have in some years damaged and occasionally destroyed the corn crop. A few of the more poorly drained areas are used chiefly for pasture. Unadapted varieties of small grains may lodge.

This very deep fertile soil is not subject to sheet erosion. Silty materials are often deposited by floodwaters. It therefore can be

cropped more intensively than any other soil in the county. A recommended rotation is corn for about 2 years, followed by 1 year of a stiff-strawed small grain, and 1 or 2 years of hay. Cultivation when the soil is wet partially destroys good tilth. Suitable rotations and supplemental practices are given in table 5 under management group 10.

Dickinson soils

The Dickinson soils are well drained to excessively drained and occur in small tracts in various parts of the county. They are generally associated with the more rolling soils on dunelike and morainic hills and ridges. They occur on a few dissected benches in close association with the Clarion soils. They differ from the Clarion soils in being more sandy and more acid throughout and in having a slightly lighter colored surface soil. A sandy substratum is usually encountered 20 to 30 inches below the surface. These soils are:

Dickinson fine sandy loam, 1 to 7 percent slopes.
Dickinson fine sandy loam, 8 to 20 percent slopes.
Dickinson loamy fine sand, 1 to 7 percent slopes.
Dickinson loamy fine sand, 8 to 20 percent slopes.

Representative profile (Dickinson fine sandy loam, 1 to 7 percent slopes):

0 to 8 inches, dark grayish-brown, dark-brown, and grayish-brown very friable weak granular loamy fine sand to sandy loam; slightly to medium acid.

8 to 23 inches, brown, grading to yellowish-brown, friable sandy loam to loam; medium acid.

23 inches +, yellowish-brown to brownish-yellow loamy fine sand containing medium and coarse sand; at depths of 30 to 36 inches the loose sands increase in coarseness and contain some gravel; slightly acid.

The principal variations are in the texture and thickness of the layers. The texture of the surface layer may range from a loamy fine sand to a loam, and the thickness from 6 to 12 inches. The subsurface layer is generally slightly finer textured and more coherent than the surface layer. Pockets of silty material are sometimes encountered in the substratum.

Most of the Dickinson soils occupy small areas in fields that are predominantly Clarion soils. These areas are cropped with the more productive Clarion soils. Fields that are dominantly of Dickinson soils are generally cropped each year, but at the time of the survey a few were idle or used for pasture. During the short dry periods that occur nearly every growing season, crops on these soils suffer from drought and the soils may drift because of wind erosion. Yields usually are lower than on adjacent finer textured soils. Conservation of moisture and control of wind erosion are necessary if yields are to be maintained at satisfactory levels. Among the practices applicable to these soils are (1) rough tillage, (2) spring plowing, so that the soil is covered during the winter months, and (3) stripcropping—the strips laid out crosswise to the direction of the prevailing winds. When strips are used, they should be cropped so that no adjacent strips are bare at the same time.

Dickinson fine sandy loam, 1 to 7 percent slopes (Da)

The largest areas of Dickinson fine sandy loam, 1 to 7 percent slopes, occur about 2 miles east of the village of Frost and 5 miles south of Easton. Some areas include a few steeper slopes than indicated. The profile is given under the heading, Dickinson Soils.

Use and management.—Most of this type was cultivated when the survey was made. It is not so subject to sheet and gully erosion as Dickinson fine sandy loam, 8 to 20 percent slopes. Recommendations for conservation and management are given in table 5, management group 8.

Dickinson fine sandy loam, 8 to 20 percent slopes (Db)

The areas of Dickinson fine sandy loam, 8 to 20 percent slopes, are generally very small. The largest tracts occur along Brush Creek south and west of the village of Kiester. The profile is similar to that of Dickinson fine sandy loam, 1 to 7 percent slopes, but is shallower throughout and has lighter and thinner surface and subsurface layers.

Use and management.—At the time of the survey this somewhat excessively drained soil was used for cultivated crops and for pastures, the use depending upon its steepness and the adjacent associated soils. It is recommended that it be used largely for hay and pasture, for it is exceptionally vulnerable to both sheet and gully erosion when cultivated. Suitable rotations and supplemental practices are given in table 5 under management group 9.

Dickinson loamy fine sand, 1 to 7 percent slopes (Dc)

Dickinson loamy fine sand, 1 to 7 percent slopes, occurs in small areas concentrated for the most part east of Frost and along the East Branch Blue Earth River northwest of Rice Lake.

The profile is similar to that of Dickinson fine sandy loam, 1 to 7 percent slopes. It differs mainly in having a coarser textured and slightly lighter colored surface soil and a coarser textured subsurface layer.

Use and management.—When the survey was made, most areas of this soil were cropped to corn and oats. These crops suffer each year during dry periods because of the low water-holding capacity of the soil. This phase is more subject to wind erosion than Dickinson fine sandy loam, 1 to 7 percent slopes. Recommendations for use and conservation are given in the description of Dickinson soils. Suitable rotations are given in table 5 under management group 8.

Dickinson loamy fine sand, 8 to 20 percent slopes (Dd)

Dickinson loamy fine sand, 8 to 20 percent slopes, is generally associated with the Dickinson loamy fine sand, 1 to 7 percent slopes, but is found on steeper slopes. The profile described for Dickinson fine sandy loam, 1 to 7 percent slopes, is similar to that of this phase, but the surface and subsurface layers are generally coarser textured and thinner.

Use and management.—This soil is usually managed like the associated Dickinson soils. The practices required for control of wind erosion and conservation of water are similar to those given in the description of Dickinson soils. Since this soil is generally less productive and more subject to deep gully erosion than Dickinson soils on less steep slopes, it should be used predominantly for hay and pasture. Suitable rotations are given in table 5 under management group 9.

Glencoe soil

Glencoe silty clay loam, 0 to 2 percent slopes (Ga)

Glencoe silty clay loam, 0 to 2 percent slopes, is scattered throughout the county in small, slightly depressed flats in the upland (fig. 3). It occurs in close association with Clarion, Nicollet, and Webster soils, in very shallow basins and sloughs, and along intermittent drainageways.

Profile description:

0 to 20 inches, black, granular silty clay loam, firm when moist, sticky when wet; slightly acid.
20 to 35 inches, dark-gray, grading to dark olive-gray, compact silty clay loam; sticky when wet but breaks into clods when dry; slightly acid to neutral.
35 to 42 inches, light olive-gray moderately plastic silty clay loam with coarse mottles of pale yellow and gray; neutral to alkaline.
42 inches +, gray to light olive-gray calcareous clay loam till mottled with light yellowish-gray and rust brown.

Variations in profile characteristics are in depth of the surface layer, which ranges from 15 to 30 inches, and depth to the calcareous layer, which ranges from 36 to 42 inches. In some places the surface is covered with 2 to 4 inches of muck or peat.

Use and management.—Most of this soil has been in permanent meadow, as it is too poorly drained for cropping in its natural condition. During recent years, however, many of the depressed flats have been drained, either by open ditches or drain tile, and are cultivated. The same crops are grown as on the surrounding higher Webster and Clarion soils.

This fine-textured soil generally occupies irregular spots, about an acre in size, within large fields of better drained soils. It is cropped with the rest of the field if it is not too wet to support farm machinery. Undrained areas are left idle or in meadow and must be skirted by farm equipment. Suitable crop rotations and supplemental management practices are given in table 5 under management group 3.

Guckeen soils

The Guckeen soils have developed from clay and silty clay glacial or lake-modified till on gently undulating to undulating topography (1 to 7 percent slopes). They are fine textured and dark colored. They occur in the northern and western parts of the county in close association with the more poorly drained Marna and Lura soils. Like the Nicollet soils mapped with Clarion silty clay loam, 1 to 3 percent slopes, these soils are imperfectly to moderately well drained, but

they differ in being finer textured and heavier throughout. The Guckeen soils in Faribault County are:

Guckeen silty clay loam, 1 to 3 percent slopes.
Guckeen silty clay loam, 2 to 7 percent slopes.

Representative profile (Guckeen silty clay loam, 2 to 7 percent slopes):

0 to 7 inches, dark-brown and very dark grayish-brown heavy silty clay loam of well-developed medium granular structure; aggregates firm when moist, sticky when wet; slightly to moderately acid.
7 to 18 inches, dark grayish-brown heavy silty clay loam of well-developed granular structure; aggregates firm when moist, plastic when wet; strongly acid.
18 to 25 inches, dark-brown and dark-gray, grading down to dark yellowish-brown, compact silty clay of well-developed fine to medium subangular blocky structure; hard when dry, very firm when moist, and very plastic when wet; medium acid.
25 to 32 inches, dark yellowish-brown to dark grayish-brown compact silty clay slightly mottled with gray; well-developed fine subangular blocky aggregates are hard when dry and very plastic when moist; medium acid.
32 to 39 inches, olive-brown silty clay slightly mottled with yellowish brown; fine subangular blocky aggregates are firm when dry and plastic when moist; slightly acid.
39 to 48 inches, mottled pale-olive, yellowish-brown, and reddish-brown massive silty clay loam containing a few pebbles; slightly acid.
48 to 58 inches, yellowish-brown silty clay loam mottled with gray; neutral to weakly alkaline.
58 inches +, calcareous clay loam till.

Variations from the above profile characteristics are in color, texture, and thickness of the surface layers and in the texture, depth to, and degree of mottling of the lower layer. Included with the Guckeen soils are a few areas of lighter colored soils that occur above and fringing the bluffs of the valley of the Blue Earth River in the northwestern part of the county. The lighter colored surface layers of these soils are probably the result of the forest vegetation.

Almost all of the area of the Guckeen soils was intensively cropped to corn, soybeans, and small grains at the time of the survey. These durable soils are very productive and especially well adapted to corn. Their high water-retaining capacity prevents crop injury caused by lack of moisture. Artificial drainage is beneficial but would not be profitable, since these soils have adequate natural drainage for locally grown crops in all except the wet seasons. The maintenance of a high level of productivity is not difficult.

Guckeen silty clay loam, 1 to 3 percent slopes (Gb)

The profile of Guckeen silty clay loam, 1 to 3 percent slopes, resembles that of the Guckeen silty clay loam, 2 to 7 percent slopes, described under the heading, Guckeen Soils. The mottling, however, is slightly closer to the surface.

Use and management.—Recommended conservation and management practices are given under Guckeen soils, and in table 5 under management group 5.

Guckeen silty clay loam, 2 to 7 percent slopes (Gc)

A typical profile of Guckeen silty clay loam, 2 to 7 percent slopes, is described under the heading, Guckeen Soils.

Use and management.—For recommended use and management, see the discussion of Guckeen soils, and in table 5 under management group 5. Since this phase is more subject to erosion than the phase with 1 to 3 percent slopes, more care should be taken in applying erosion-control practices.

Harpster soil

Harpster silty clay loam, 0 to 2 percent slopes (Ha)

Harpster silty clay loam, 0 to 2 percent slopes, is an imperfectly to poorly drained soil similar to both the Webster and Blue Earth silty clay loams. It is closely associated with these soils and in places cannot be separated from them. It differs from the Webster mainly in having a lighter colored and more friable surface soil and an accumulation of lime in the upper layers, and from the Blue Earth in having better drainage. It often occurs as a complex of low microrelief—small low calcareous knolls adjacent to very shallow basins. It also occurs on the outer edges of areas of Webster soil, where it is locally known as alkali rims, or on other low rises surrounded by Webster or Blue Earth soils.

In many places this soil is covered with a gray limy surface that changes upon drying into a light-gray white powdery film. Often this film may be crusted. Small snail shells and other fragments may occur on and in the surface soil.

Profile description:

0 to 16 inches, dark-gray, light brownish-gray, and gray silty clay loam, very friable to fluffy when dry; as in the Blue Earth soil, the fluffiness is derived from the calcareous, well-developed fine granules, which are high in organic content and slightly plastic when wet.

16 to 30 inches, dark-gray, grading to gray, highly calcareous silty clay loam mottled with grayish brown, pale yellow, and pale olive; the weakly developed fine granules are friable when moist and moderately plastic when wet.

30 inches +, light yellowish-brown highly calcareous loam to silty clay loam mottled with light gray and pale yellow.

Use and management.—Most areas of this soil have been artificially drained and at the time of the survey were cropped in the same way as the adjacent Webster silty clay loam, 0 to 2 percent slopes. Although naturally high in organic-matter content, this soil is not always productive. Applications of both phosphate and potash are beneficial. For recommended soil management practices, see use and management of Blue Earth silty clay loam, 0 to 2 percent slopes, under management group 4 in table 5.

Lura soil

Lura silty clay, 0 to 2 percent slopes (La)

Lura silty clay, 0 to 2 percent slopes, is a very poorly drained soil that occupies slightly depressed flats on nearly level lake and till

plains in close association with the Beauford and Marna soils. The soil is dark, fine textured, and deep. Many areas are found in sluggish shallow drainageways. A number of these old sloughs are located west of Wells. Large areas of this soil can be found in Minnesota Lake and Lura Townships.

Profile description:

0 to 11 inches, black, granular silty clay, high in organic matter; aggregates firm when moist, sticky when wet; slightly acid.

11 to 17 inches, black, grading with depth to dark-gray, silty clay mottled with brownish yellow and light brownish gray; the coarse granular and fine subangular blocky aggregates are firm when moist and plastic when wet; many tongues of the black layer above extend into the upper part of this horizon; slightly acid.

17 to 38 inches, light-olive, grading to light olive-gray, clay slightly mottled with olive yellow and gray; mottling increases with depth; the fine subangular blocky aggregates very firm and waxy when moist and very plastic when wet; medium acid.

38 to 48 inches, mottled light-gray and yellowish-brown massive silty clay; very slightly acid to neutral.

48 inches +, limy silty clay loam till.

Variations from the above profile characteristics are in depth of the dark surface soil, which may extend more than 24 inches; the presence of many pebbles below 24 inches; and segregations in the deeper subsoil, mainly gypsum crystals.

Use and management.—The use and management practices for this soil are the same as those used on Beauford silty clay, 0 to 2 percent slopes, but more care should be taken to insure adequate drainage. Suitable rotations and supplemental practices are given under management group 3 in table 5.

Marna soils

The fine-textured, deep, and dark-colored Marna soils have developed from clay loam and silty clay loam glacial and lake-modified till. They occupy nearly level to gently undulating slopes of less than 5 percent gradient. These poorly drained soils occur in association with the poorly drained Beauford, the very poorly drained Lura, and the better drained Guckeen soils. They differ from the Webster soil in being finer textured and more deeply leached. Free lime carbonates are generally found 48 to 60 inches below the surface. They are more gritty throughout, less plastic, and slightly better drained than the Beauford soil. Large areas occur in the townships of Minnesota Lake, Dunbar, and Lura. These soils are:

Marna silty clay loam, 0 to 2 percent slopes.

Marna silty clay loam, 2 to 5 percent slopes.

Representative profile (Marna silty clay loam, 0 to 2 percent slopes):

0 to 16 inches, black, granular silty clay loam; aggregates firm when moist, sticky when wet; color grades to very dark brown in the lower part; contains few pebbles; slightly acid.

16 to 22 inches, very dark-gray silty clay loam slightly specked with olive; fine subangular blocky aggregates firm and waxy when moist, plastic when wet; contains a few pebbles; slightly acid.

22 to 36 inches, dark-olive, grading to olive, silty clay slightly mottled with yellowish red; the fine subangular blocky aggregates very firm and waxy when moist and very plastic when wet; contains more pebbles than layer above; very slightly acid.

36 to 46 inches, pale-olive, massive silty clay loam with yellowish-brown mottles; pebbles numerous; neutral.
42 inches+, light olive-gray, calcareous, slightly compact silty clay loam till with fine to medium mottles of yellowish red; firm when moist; numerous pebbles, including many of limy origin, and some shale fragments.

Most of the area occupied by the Marna soils has been artificially drained. At the time of the survey the soils were cropped to corn, soybeans, small grain, canning crops, and sugar beets. They are especially suited to corn and soybeans. Yields of soybeans average about 24 bushels an acre when grown in a 5-year rotation consisting of 3 years of corn, 1 year of soybeans, and 1 year of small grain.

Plowing and other tillage operations are a problem because of the heavy-textured surface soil, which can be worked only within a narrow moisture range. Fall plowing is recommended, as the alternate freezing and thawing of the overturned soil will aid in the formation of good tilth. Fall and spring plowing serve as a practical control of quackgrass. Turning under of sweetclover improves soil tilth and supplies additional nitrogen for the succeeding crop.

Marna silty clay loam, 0 to 2 percent slopes (Ma)

The profile of Marna silty clay loam, 0 to 2 percent slopes, is described under Marna Soils. Recommendations for use and management are given under management group 2 in table 5, and under the heading Marna Soils.

Marna silty clay loam, 2 to 5 percent slopes (Mb)

Marna silty clay loam, 2 to 5 percent slopes, has a profile like that described under Marna Soils, except that the surface soil is generally thinner and slightly lighter colored and the entire profile is slightly better drained.

Use and management.—Use and management suggestions under the heading Marna Soils apply to this phase, but special effort should be made to prevent sheet erosion. Suitable rotations are given under management group 2 in table 5.

Marsh (Mc)

Marsh consists of wet and periodically flooded areas covered with water-tolerant grasses and grasslike plants. Sedges (locally called wiregrass), cattails, and rushes dominate most of the area. During the survey this marshland was not dry enough to permit examination and detailed mapping. The largest concentration is found in the northeastern corner of Brush Creek Township southeast of Lower Walnut Lake.

Mixed alluvial land (Md)

Mixed alluvial land is an association of many alluvial soils occurring as a mixture of alluvial deposits on flood plains. No typical profile is described because these soils vary. They range from sandy loam to silty clay loam, from very dark brown to gray, and from moderately

well to very poorly drained. Furthermore, this land type is subject to overflow, and the periodic deposition of soil material may change the drainage and the surface texture and color. In some places the soil may become marshy because of the damming action of debris, whereas in others it may become better drained because of new channels cut through areas previously dammed. The land is subject to streambank erosion.

Use and management.—This land type usually remains idle or is used for pasture and woodland. The most prominent trees are cottonwood, golden willow, elm, and ash. At the time of the survey small areas, though subject to flooding, were cropped to corn during dry seasons. The fields were generally so small, however, and the soil and moisture conditions were so variable that growth was spotty. This land type is not, as a whole, considered suitable for cropping and is best used for pasture.

Nicollet and Clarion complex

Nicollet and Clarion silty clay loams, 1 to 3 percent slopes (Na)

Nicollet and Clarion silty clay loams, 1 to 3 percent slopes, is a complex of deep dark-colored well drained to moderately well drained soils. It developed from friable calcareous loam and coarse clay loam till on gently undulating uplands. The two soil types are so closely intermingled that no attempt was made to separate them on the soil map. On an average, 75 percent of the total acreage is Nicollet silty clay loam and the rest is Clarion silty clay loam and silt loam. The Nicollet silty clay loam occupies the broader, nearly level to very slightly undulating areas on slopes of less than 3 percent in gradient. The Clarion occupies the crests of ridges that are dominantly 2 to 5 percent in gradient. In upper drainageways, however, the Nicollet soil may be found on a few slopes greater than 3 percent.

Profile description of the Nicollet silty clay loam:

0 to 15 inches, very dark-brown silty clay loam high in organic matter; well-developed granules friable when moist and slightly plastic when wet; medium acid.

15 to 23 inches, yellowish-brown silty clay loam streaked with grayish brown and brown; the subangular blocky aggregates firm when moist, slightly plastic when wet; slightly acid.

23 to 38 inches, pale-yellow and olive-yellow heavy silty clay loam specked with brownish yellow; subangular blocky aggregates firm when moist, plastic when wet, and brownish-yellow when crushed; neutral.

38 inches+, light yellowish-brown calcareous clay loam to loam till.

Variations in profile characteristics are mainly in the thickness of the surface soil, in the depth to and degree of mottling in the subsurface layer and subsoil, and in the depth to lime in the subsoil. This soil is similar to the Guckeen soils in degree of mottling and surface drainage. It differs, however, in having a coarse-textured and less acid subsurface layer and subsoil.

The profile of the Clarion silty clay loam is like that of the previously described Clarion silt loam, 2 to 7 percent slopes, but it differs in having slightly thicker and finer textured surface and subsurface layers.

Use and management.—This complex constitutes some of the best agricultural land in the county. Almost all of it was under cultivation

at the time of the survey. Among the important crops suitable for this complex are corn, soybeans, oats, sugar beets, sweet corn, and canning peas.

Since the soils of this complex are high in organic matter and moderately friable, they are easily penetrated by plant roots. They are subject to erosion on their longest slopes and on slopes that receive runoff from steeper gradient above, but only during rains of high intensity. The maintenance of a high level of productivity is not difficult. Suitable rotations and supplemental practices are given under management group 6 in table 5.

Peats and Mucks

Peats and Mucks developed where the remains of plant growth accumulated because of continued wetness. They consist of organic matter that is more or less decomposed. This broad group of organic soils is separated on the basis of degree of decomposition. Peats consist of the relatively raw material, and Mucks of the relatively decomposed organic material developed from the Peats. The Peats and Mucks are further divided according to depth to the underlying mineral layer. Areas that have less than 36 inches of organic material are mapped as shallow phases. Peats and Mucks occur throughout the county but particularly in the southeastern part.

At the time of the survey most areas of these soils were undrained and used for permanent pasture. Some had been artificially drained. The drained fields were predominantly seeded to reed canarygrass, bromegrass, or clover and timothy; but a few were in cultivated crops, usually corn or flax. In the Hollandale area in adjacent Freeborn County, large areas of these soils are used for truck crops, including potatoes.

Certain precautions are necessary in farming these soils to prevent their damage by unrestrained drainage and improper use. Crop loss may result from many causes, including frost, flood, fire, drought, and erosion. Blowing may injure growing plants if Peat and Muck are kept in intertilled crops continuously. In large areas, field windbreaks and stripcropping will help reduce this hazard.

To obtain good yields from the drained soils, the water table should be held 2 to 3 feet below the surface and phosphate and potash fertilizer applied yearly. No lime need be used. These Peats and Mucks are classified broadly by the Minnesota Agricultural Experiment Station (1) as high-lime Peats and Mucks because they are well supplied with lime for all agricultural crops. If oats or barley are planted, stiff-stemmed varieties should be grown in order to avoid excessive lodging. Wheat is not recommended for these soils. Alfalfa is unsatisfactory because of its susceptibility to winterkilling. Corn is not likely to mature, hence it should be planted for silage or fodder. Excellent yields of silage, ranging from 12 to 14 tons an acre, may be expected. Truck crops, including potatoes, do very well on properly fertilized Peats and Mucks. Some of the other common root crops well suited to these soils are sugar beets, onions, carrots, table beets, parsnips, and radishes.

When properly drained and fertilized, these soils will produce good yields of hay and pasture. Timothy seeded alone, or in a mixture

Figure 10.—**Hummocky pasture on Peat; Clarion soils in meadow in background.**

with alsike clover and bromegrass, is well adapted. Reed canarygrass is particularly well adapted for the partially drained Peats and Mucks. Stands of both grasses and legumes used for pasture require annual rolling to prevent the soils from becoming hummocky (fig. 10).

More information on handling of peat and muck soils and their adaptability to crops can be obtained from the Department of Soils, Minnesota Agricultural Experiment Station, St. Paul, Minn.

Peat (Pa)

Peat is found for the most part in depressed flats in the southeastern part of the county.

Profile description:

10 to 20 inches, very dark grayish-brown, black when wet, moderately well-decomposed peat of fine granular structure.

20 to 30 inches, very dark grayish-brown, streaked with dark-brown, well-decomposed peat containing many particles of fibrous plant material.

30 to 36 inches, olive-gray, very friable, fine granular calcareous silt embedded with brown and yellowish-brown fibrous peat from the remains of sedges and reeds.

36 to 60 inches, either highly decomposed calcareous organic matter or marl that overlies the calcareous clay loam of the old lake bottom.

For recommended use and management practices, see table 5, management group 11.

Peat, shallow phase (Pb)

The main difference between Peat, shallow phase, and Peat is in depth to underlying mineral matter. In the shallow phase, the depth of peat ranges from 12 to 36 inches. For recommended use and management see table 5, management group 11.

Muck (Me)

Muck differs from peat in the degree of decomposition. In Muck soil the plant material is so completely decomposed that its botanical identification is impossible.

Profile description:

0 to 11 inches, black, fine granular muck; layer usually more than 8 inches deep and may extend to 2 feet.
11 to 24 or 36 inches, less decomposed brown mixtures of muck and fibrous peat.
36 to 60 inches, marl or a calcareous clay loam till.
60 inches +, calcareous clay loam till.

For recommended use and management practices, see table 5, management group 11.

Muck, shallow phase (Mf)

The surface layer of this organic soil is the same as that of Muck, but the mineral subsoil is reached at depths ranging from 12 to 36 inches. In most cases a marl is encountered at a depth of about 18 inches. Marl may, however, be exposed at the surface. Generally this type occupies alluvial bottom lands in the southeastern part of the county. For recommended use and management, see table 5, management group 11.

Storden soils

Storden-Lakeville loams, eroded, 13 to 30 percent slopes (Sa)

Storden-Lakeville loams, eroded, 13 to 30 percent slopes, consists of a mixture of Storden loam and silt loam and Lakeville loam and sandy loam. Areas of both are intermingled in an intricate pattern. These dominantly brown soils occur on slopes greater than 12 percent in association with Clarion and Glencoe soils. They occupy hilly uplands of morainic origin and consist of ridges, hummocks, knobs, and complementary basins. Some of the basins are occupied by water and peats, but others are dry. The topography is choppy; it consists of short complex variable slopes.

The profile described for Storden loam and silt loam, 13 to 30 percent slopes, is typical of the Storden soil in this complex. The profile of the Lakeville loam is described in Clarion-Lakeville loams, eroded, 8 to 13 percent slopes.

Use and management.—At the time of the survey it was estimated that slightly less than two-thirds of this complex was under cultivation. The remaining areas were in pasture and meadow. Crop yields were slightly lower than those obtained on Clarion-Lakeville loams, eroded, 8 to 13 percent slopes. Numerous eroded spots appeared in most of the cultivated fields. Several deep gullies were noted at the time of survey, and most of the pastures were overgrazed.

Maintenance and improvement of fertility and control of erosion are the chief problems of management. The soils of this complex should not be used for intertilled crops, as they are highly susceptible to erosion, low in organic matter and nitrogen, and subject to fertility deterioration. In general they should be used for hay and improved

pasture. If the soils are cultivated, special precautionary measures should be taken. Rotations with a high proportion of legumes and, grasses, such as those listed under management group 9 in table 5, should be used. Barnyard manure and fertilizers should be applied in the rotation.

Storden loam and silt loam, 13 to 30 percent slopes (Sb)

Storden loam and silt loam, 13 to 30 percent slopes, are shallow, friable, and somewhat excessively drained. They have developed from friable limy loam till on rolling to hilly topography. They are found in the southeastern part of the county and along the Blue Earth River.

Profile description of Storden loam:

0 to 8 inches, brown to grayish-brown very friable loam of weak crumb structure; neutral to mildly alkaline.
8 to 14 inches, brownish-gray friable loam; neutral to mildly alkaline.
14 to 28 inches, yellowish-brown to brownish-yellow slightly calcareous friable loam.
28 inches +, yellow and very pale-brown, friable, calcareous loam till; slightly spotted with brownish gray and light gray in the lower part.

The main variations in profile characteristics are in the color and depth of the surface soil and subsurface layer. In most fields made up of these soils, calcareous till may be seen on the surface.

The silt loam Storden soil has a profile like the one described above except that the texture of the surface soil and subsurface layer is silt loam.

Use and management.—Storden loam and silt loam, 13 to 30 percent slopes, are subject to severe sheet and gully erosion and are deficient in organic matter and nitrogen. About half their total area is under cultivation; the rest is largely in pasture. The main crops are corn, oats, and alfalfa hay. Their high lime content and friable subsoil favor the production of alfalfa.

These soils are not suited to continuous cropping. They should not be used for corn and soybeans. It is recommended that they be seeded to alfalfa and bromegrass and used for hay and pasture. Specific rotations are suggested under management group 9 in table 5.

Terril soils

Terril loam and silt loam, 1 to 7 percent slopes (Ta)

Terril loam and silt loam, 1 to 7 percent slopes, are associated with the Clarion and Storden soils on lower slopes and coves. They are generally found at the base of slopes, where they merge with the lower lying Webster and Glencoe soils. Where they merge with the higher lying Clarion and Storden soils or occur between streams and adjacent bluffs, they may be found on slightly steeper gradients (fig. 3). These well-drained soils are developed from the same kind of parent materials as the Storden, Clarion, and Webster soils. They are like the Clarion soils but differ in having a thicker surface soil and more friable subsurface layer. The thickness of the surface soil varies

according to the accumulation of colluvial silty material at the base of the slopes. Most areas of Terril loam and silt loam, 1 to 7 percent slopes, are in the southern part of the county.

Profile description of Terril silt loam:

0 to 26 inches, black, friable, granular silt loam; slightly acid to neutral.
26 to 32 inches, dark-gray, friable, granular heavy loam to clay loam; neutral.
32 to 42 inches, dark-gray, friable to firm loam of subangular blocky structure; neutral.

Except for texture of the surface layer, the profile of Terril loam is the same as described for Terril silt loam.

Use and management.—At the time of the survey most areas of these soils were in crops. Only a few small areas between the pastured alluvial soils and the bluffs were not cultivated. Many tracts occupy slightly lower areas in fields of Clarion soils and are cropped with those soils. In general, these soils are slightly more productive than the Clarion soils because of their thicker surface soil and higher organic-matter content. Suitable use and management are suggested under management group 6 in table 5.

Truman soils

The Truman are friable dark-colored Prairie soils. They are derived from loose water-sorted silt and fine sand that was deposited on gently undulating to gently rolling uplands. The parent material is water-reworked glacial till located in regions of former glacial lakes. These well-drained soils differ from the associated Clarion soils in being dominantly stone free and silty throughout; other differences are that they contain few or no pebbles or larger stones and have free lime at lower depths.

Profile description:

0 to 10 inches, very dark grayish-brown, very friable silt loam; the granules readily crush to dark yellowish brown; slightly acid.
10 to 15 inches, grayish-brown, very friable silt loam; coarse granules, partly coated with yellowish brown, crush readily to yellowish brown; slightly acid.
15 to 24 inches, brown friable silt loam; subangular blocky aggregates, coated with brownish yellow, crush readily to pale yellow; slightly acid.
24 to 32 inches, brownish-yellow, friable, heavy silt loam; coarse blocky aggregates that crush to yellow.
32 to 41 inches, yellow, friable silt loam; occasional pebbles present; slightly acid.
41 inches +, dominantly yellowish-brown calcareous silts interbedded with fine sand.

Variations in profile characteristics are mainly in the thickness and color of the surface soil. The thickness ranges from about 6 inches on steeper slopes or the crests of some hills to 15 inches on the lower slopes. In places, the subsoil may be mottled. Loam or clay loam glacial till may be encountered at depths of 36 inches.

Truman silt loam, 1 to 5 percent slopes (Tb)

The profile of Truman silt loam, 1 to 5 percent slopes, is similar to that described for Truman soils but differs mainly in having a slightly finer textured and slightly mottled subsurface layer.

Use and management.—When the survey was made, most of this soil was used for crops like those grown on Clarion soils of comparable slopes. It produced slightly lower yields, however, and was more subject to sheet and gully erosion than the Clarion soils. Maintenance of a high level of productivity requires the addition of organic matter, and crop rotations with a year of grasses and legumes about every third year. Waterways should be kept in sod to reduce danger of gullying. See management group 6 in table 5 for suitable rotations.

Truman silt loam, 6 to 12 percent slopes (Tc)

Truman silt loam, 6 to 12 percent slopes, is found in the locations described for the Truman soils and has the typical profile characteristics. On steeper slopes of this phase, however, the horizons are slightly thinner.

Use and management.—At the time of the survey most areas of this soil were under cultivation and cropped with the adjacent Truman soil on 1 to 5 percent slopes and with Clarion soils. A slightly greater percentage of this phase was in pasture. Yields of crops were slightly lower than on the Clarion soils.

This phase has many more eroded spots than the phase with 1 to 5 percent slopes. It is well suited to legumes and grasses, such as alfalfa and bromegrass, and less suited to corn. Intertilled crops should not be grown more often than 1 year in 4. It is important that runoff water should not be allowed to concentrate. All waterways should be in sod, as this soil is extremely susceptible to gully erosion. Recommended use and management practices are given under management group 7 in table 5.

Volin soil

Volin silt loam, 0 to 2 percent slopes (Va)

Volin silt loam, 0 to 2 percent slopes, occurs on nearly level high bottoms in the flood plains of major streams. It is moderately well drained. The soil is closely associated with Comfrey silty clay loam, 0 to 1 percent slopes. It differs from the associated soil mainly in being better drained, better developed, and less subject to flooding.

Profile description:

- 0 to 15 inches, very dark-brown and grayish-brown, friable, fine granular silt loam, high in organic matter; neutral.
- 15 to 30 inches, dark-gray granular silty clay loam slightly specked with brownish yellow; firm when moist, plastic when wet; slightly acid.
- 30 inches +, gray silty clay loam slightly mottled with yellowish brown; neutral to slightly acid.

Use and management.—Most of this soil was cultivated and planted to corn at the time of the survey. Some fields were used for small grain. Since this soil occurs on higher elevations than associated soils on the flood plains, it is above the present overflow level except during periods of extremely high water. It therefore can be seeded or planted as early as soils on the adjacent upland. See management

group 6 in table 5 for suitable crop rotations and supplemental practices.

Webster soil

Webster silty clay loam, 0 to 2 percent slopes (Wa)

Webster silty clay loam, 0 to 2 percent slopes, is a deep, dark-colored, imperfectly to poorly drained soil. It is associated with the better drained Clarion and Nicollet soils and the more poorly drained Glencoe soil and closely associated with Harpster silty clay loam, 0 to 2 percent slopes. This soil has developed from the same friable medium-textured limy glacial till parent material as the Clarion soils but under poorer drainage. It is one of the most extensive soils in Faribault County and occurs in large widely distributed areas on the nearly level or very slightly depressed uplands (fig. 3).

Profile in a cornfield when soil was moist:

0 to 14 inches, black (dark gray when dry) silty clay loam, high in organic matter; easily crumbles into well-developed medium to fine granules when disturbed; friable to firm when moist and slightly sticky when wet; few granitic pebbles; very slightly acid to neutral.

14 to 21 inches, dark-gray silty clay loam slightly streaked with dark grayish brown; when dry, the aggregates tend to form prisms; in the upper part these prisms break easily into sharp granules, and in the lower part into fine subangular blocks; material is firm when moist, plastic when wet; granitic pebbles more numerous than in layer above; some limy pebbles; very slightly acid to neutral.

21 to 30 inches, very dark-gray, dark-gray, and olive calcareous silty clay loam streaked with dark brown, rust brown, and olive gray; limy pebbles more numerous than layer above; tongues of the upper horizon extend into this layer.

30 inches +, grayish-brown, light-gray, and olive highly calcareous clay loam till parent material mottled with yellowish brown and yellowish red; friable when moist, slightly plastic when wet; contains many pebbles (mostly of limy origin), many limy nodules, and a few shale fragments; in places this till is stained with reddish-brown iron compounds.

Variations in the profile characteristics are in texture, in thickness of the layers, and in depth to calcareous till. The average depth to till ranges from 2 to 3 feet.

Use and management.—At the time of the survey nearly all areas of this soil were artificially drained and cropped to corn, soybeans, small grains, sugar beets, and canning crops. Grasses and clovers were grown to a lesser extent. The very few undrained areas supported a rank growth of prairie and marsh grasses. This soil has a high water-retaining capacity. It is moderately permeable to water, however, and draintiles reasonably spaced will adequately remove surplus water. A good seedbed can be prepared easily from its surface soil, which is high in organic matter and moderately friable. Its high inherent fertility favors good yields of cultivated crops. Many fields of this soil are cropped to corn for two or more consecutive years.

These soils can be maintained, even though cropped rather intensively in rotations that consist of 40 percent or more of intertilled crops such as corn. Barnyard manure, however, should be applied, crop residues returned, and grasses and legumes included in the rotation. See management group 1 in table 5 for suitable crop rotations.

CAPABILITY GROUPS OF SOILS

In order to group soils by their capability, an estimate is made of the relative suitability of each soil for crops, grazing, forestry, or wildlife. The estimate is a consensus reached by several persons who know the soils and work with them. The capability grouping reflects the natural limitations of the soil and is useful along with the management groups in choosing good uses and major treatment needs of each soil.

Soils that are nearly level, well drained, free from overflow, fairly fertile, and otherwise not limited in use and management, are placed in capability class I. They are widely adaptable and their user has many choices. He can use his class I soils for crops, without special practices, and can choose one of several cropping systems; or he may use the soil for pasture, woodland, or some other purpose.

Soils are placed in capability class II if they are a little less widely adaptable or have greater conservation needs than those in class I. For example, the best and most fertile of the gently sloping soils are in capability class II. A gently sloping soil must be farmed on the contour, or kept covered with vegetation more of the time, or managed in some other way to control runoff and erosion. Other kinds of class II land require special management because of excess water on or in the soil, because of low moisture-holding capacity resulting from sandy texture or shallow depth, or because of the climate in which they are located.

Soils are placed in capability class III if they are still less adaptable or have more stringent management requirements than those in class II and yet can be used on a longtime basis for a satisfactory cropping system. Soils even less adaptable than those in class III, but usable for tillage part of the time or with special precautions, are in class IV.

Soils not suitable for the recurring tillage required by ordinary field crops are in capability classes V, VI, VII, or VIII. Class V is not used in Faribault County. Capability class VI contains the soils, many of them steep, that yield fairly good amounts of forage or of forest products but should not be cultivated for animal crops. Some of them can be disturbed enough to prepare them for orchards, tree crops, or longtime pastures. Soils in class VII are more limited than those in class VI, are not suitable for cultivation, and usually give only fair or poor yields of forage or wood products. Soils in class VIII (none mapped in this county) have such severe limitations that they produce little useful vegetation. They may be attractive as landscapes and may be parts of useful watersheds. Some have a little value for production of wildlife.

Capability subclasses.—Most of the capability classes include soils that differ greatly from each other. Class II in this county, for example, includes some well-drained soils that are gently sloping and need chiefly control of erosion, and also some imperfectly drained soils limited chiefly by too much water during part of the year. It is convenient to recognize capability subclasses, based on the dominant kind of limitation. As many as four subclasses may be recognized, according to the following dominant limitations: Risk of erosion (e), excess water (w), shallow or droughty soil (s), and extremely hazardous climate (c). Subclasses are denoted by a small letter following the class number, such as IIe or IIw.

Subclasses are somewhat broader groupings than the management groups described in table 5. In 5 of the management groups, the soils of the group fall within 1 capability subclass. The other 7 management groups each contain soils of more than 1 subclass. In management group 5, for example, Guckeen silty clay loam, 1 to 3 percent slopes, meets the requirements for class I; Guckeen silty clay loam, 2 to 7 percent slopes, is in subclass IIe because of the need for erosion-control practices.

Capability classes and subclasses

The capability classes and subclasses in Faribault County are as follows:

Class I.—Soils safe for use under intensive cultivation, without special practices to control runoff or erosion, and which may be expected to produce high yields with good soil and crop management.

Class II.—Soils that can be used for tilled crops but under slight risks of erosion or other slight limitations.

- IIe: Productive soils, gently sloping.
- IIw: Imperfectly or poorly drained soils, nearly level or gently sloping.

Class III.—Soils that can be used for tilled crops but under moderate risks of erosion or other moderate limitations.

- IIIe: Moderately sloping soils.
- IIIw: Nearly level soils, wet and difficult to manage.
- IIIs: Moderately sloping sandy soils.

Class IV.—Soils that have severe limitations or high risks of soil damage when used for cultivation and when so used require special management.

- IVe: Moderately steep slopes.
- IVs: Gently sloping very sandy soils.

Class VI.—Soils too steep, too sandy, or too wet for cultivation; suitable for pasture.

- VIe: Steep loams and silt loams.
- VIw: Soils subject to frequent flooding.
- VIs: Steep sandy soils.

Class VII.—In this county, moderately sloping or steep very sandy soils too droughty and erodible for cultivation and of low suitability for pasture.

- VIIs: Moderately sloping or steep very sandy soils.

The capability class and subclass in which each soil has been placed are shown below.

	Capability class and subclass
Beach sand	IVs.
Beauford silty clay, 0 to 2 percent slopes	II.
Blue Earth silty clay loam, 0 to 2 percent slopes	IIIw.
Clarion fine sandy loam, 1 to 7 percent slopes	IIe.
Clarion fine sandy loam, 8 to 20 percent slopes	IIIe (8 to 12 percent slopes); IVe (12 to 20 percent slopes).
Clarion-Lakeville loams, eroded, 8 to 12 percent slopes	IVe.
Clarion loam, 8 to 12 percent slopes	IIIe.
Clarion silt loam, 2 to 7 percent slopes	IIe.
Comfrey silty clay loam, 0 to 1 percent slopes	IIw; VIw if subject to frequent overflow.

	Capability class and subclass
Dickinson fine sandy loam, 1 to 7 percent slopes	IIIe.
Dickinson fine sandy loam, 8 to 20 percent slopes	IIIs (8 to 12 percent slopes); VIs (12 to 20 percent slopes).
Dickinson loamy fine sand, 1 to 7 percent slopes	IVs.
Dickinson loamy fine sand, 8 to 20 percent slopes	VIIs.
Glencoe silty clay loam, 0 to 2 percent slopes	IIIw.
Guckeen silty clay loam, 1 to 3 percent slopes	I.
Guckeen silty clay loam, 2 to 7 percent slopes	IIe.
Harpster silty clay loam, 0 to 2 percent slopes	IIw.
Lura silty clay, 0 to 2 percent slopes	IIIw.
Marna silty clay loam, 0 to 2 percent slopes	IIw.
Marna silty clay loam, 2 to 5 percent slopes	IIe.
Marsh	
Mixed alluvial land	VIw.
Muck	IIIw.
Muck, shallow phase	IIIw.
Nicollet and Clarion silty clay loams, 1 to 3 percent slopes	I.
Peat	IIIw.
Peat, shallow phase	IIIw.
Storden-Lakeville loams, eroded, 13 to 30 percent slopes	IVe (13 to 18 percent slopes); VIe (18 to 30 percent slopes).
Storden loam and silt loam, 13 to 30 percent slopes	IVe (13 to 18 percent slopes); VIe (18 to 30 percent slopes).
Terril loam and silt loam, 1 to 7 percent slopes	IIe.
Truman silt loam, 1 to 5 percent slopes	IIe.
Truman silt loam, 6 to 12 percent slopes	IIIe.
Volin silt loam, 0 to 2 percent slopes	I.
Webster silty clay loam, 0 to 2 percent slopes	IIe.

GENERAL FEATURES OF FARIBAULT COUNTY

Climate

Rather uniform climatic conditions prevail throughout the county. Climatic data collected at the United States Weather Bureau Station at Winnebago in the northwest part of the county are therefore regarded as applicable to the county as a whole. These data, compiled for the period from 1894 to 1945, are reported in table 8.

Wide extremes in temperature from summer to winter characterize this area. The maximum range is from a low of −35° F. to a high of 107°. Winters are cold and summers warm. In midsummer, noon temperatures above 90° are common.

The average frost-free season of 146 days extends from May 7 to October 1. Killing frosts have occurred as late as May 31 and as early as September 8. Notwithstanding these extremes, the growing season each year is long and warm enough to produce Corn Belt crops. Severe frost damage to the corn crop during the normal growing season is rare.

Slightly more than two-thirds of the annual precipitation falls during the spring and summer. The average yearly rainfall gradually increases during spring, remains rather uniform during the main growing season from May through September, and diminishes in the fall. The least precipitation comes in winter and chiefly as snow. The average annual snowfall is about 32 inches.

Extremely wet or dry years are rare. One to several torrential rains occur each year. These high-intensity rains damage crops by floodwater, and by runoff that may cause gullies and the loss of valuable topsoil.

TABLE 8.—*Normal monthly, seasonal, and annual temperature and precipitation at Winnebago, Faribault Co., Minn.*

[Elevation, 1,110 feet]

Month	Temperature [1]			Precipitation [2]			
	Average	Absolute maximum	Absolute minimum	Average	Total for the driest year	Total for the wettest year	Average snowfall
	°F.	°F.	°F.	Inches	Inches	Inches	Inches
December	20. 1	60	−26	0. 84	0. 20	0. 94	5. 6
January	14. 2	57	−35	. 77	1. 70	. 25	7. 5
February	17. 5	73	−30	. 90	. 15	. 90	6. 8
Winter	17. 3	73	−35	2. 51	2. 05	2. 09	19. 9
March	31. 1	85	−20	1. 27	. 07	1. 06	6. 5
April	46. 2	95	0	2. 33	. 69	4. 55	2. 1
May	58. 4	95	23	3. 98	1. 72	11. 70	. 2
Spring	45. 2	95	−20	7. 58	2. 48	17. 31	8. 8
June	67. 5	100	33	4. 59	2. 61	7. 22	0
July	72. 9	106	38	3. 59	1. 93	6. 86	0
August	70. 5	106	32	3. 47	3. 75	2. 52	0
Summer	70. 3	106	32	11. 65	8. 29	16. 60	0
September	61. 9	99	22	3. 55	2. 18	. 75	(3)
October	49. 8	93	0	1. 98	. 30	3. 14	. 6
November	33. 4	75	−11	1. 36	. 19	1. 60	2. 7
Fall	48. 4	99	−11	6. 89	2. 67	5. 49	3. 3
Year	45. 3	106	−35	28. 63	[4] 15. 49	[5] 41. 49	32. 0

[1] Average temperature based on a 58-year record, 1895 to 1952; highest and lowest temperatures from a 37-year record, 1894 to 1930.
[2] Average precipitation based on a 59-year record, 1894 to 1952; wettest and driest years on a 37-year record, 1894 to 1930; snowfall on a 36-year record, 1895 to 1930.
[3] Trace. [4] In 1910. [5] In 1908.

Physiography, relief, and drainage

Most of the county is nearly level to gently undulating (fig. 11). Many of the slight slopes, some almost imperceptible, descend toward watercourses. Generally such a surface provides natural drainage and facilitates artificial drainage. There is therefore little nonarable land in the county. The steeper slopes, although of minor extent,

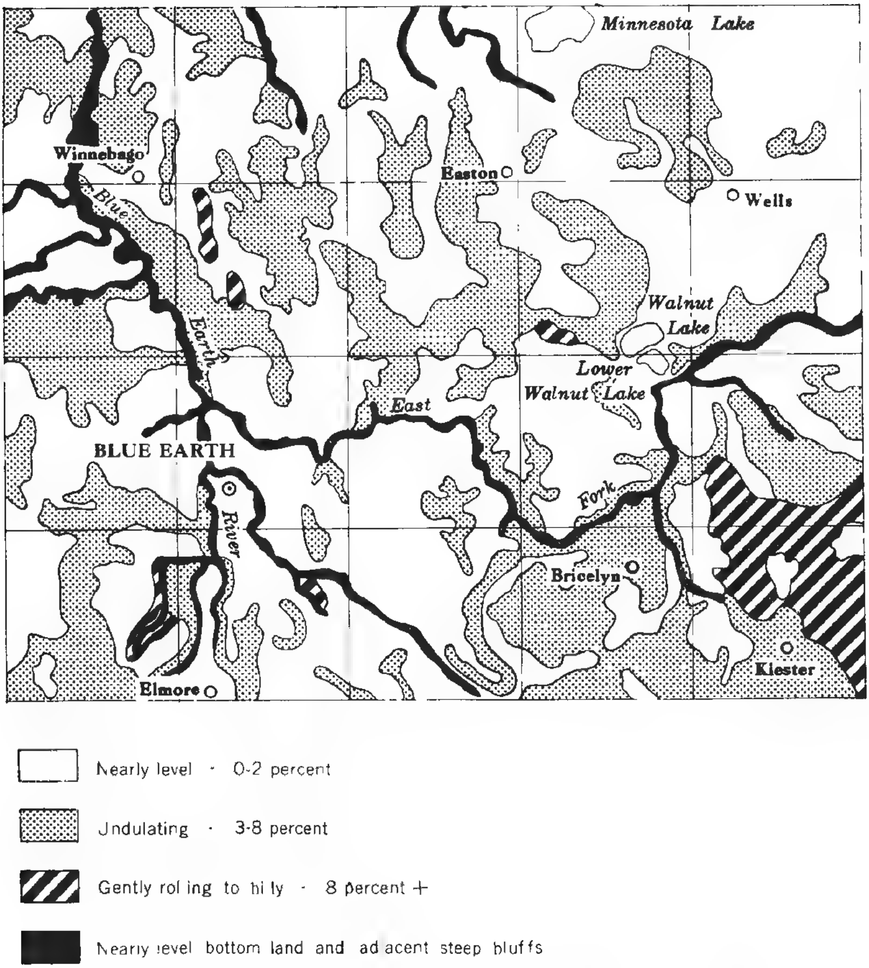

***Figure 11.*—General distribution of soils in Faribault County according to slope.**

interrupt the otherwise unbroken landscape. The broken areas with steeper slopes consist of (1) river bluffs and (2) belts or irregular hills or moraines. The bluffs are almost entirely confined to very narrow belts bordering major streams. The moraines are prominent in Kiester Township. Bedrock underlying the layer of glacial drift is not exposed in the county. Near its source the East Branch Blue River in the southeastern part of the county is only 30 feet below the general level of the upland surface. Farther downstream at the town of Blue Earth, the depth of the Blue Earth River gorge is 50 feet; it increases northward through the township of Verona and Winnebago City to 90 feet.

The belts of irregular hills and moraines are rather extensive. They cover that part of the county not occupied by the nearly flat expanse of glacial till. There are two belts: One in the southeastern corner of

the county extends northward and northwestward to a point northeast of the village of Delavan, the other extends north from Iowa 1 to 2 miles into the southwestern part of the county. An interesting firsthand account of the physiography and surface geology was reported by Upham (*14*), an outstanding geologist who explored the county many years ago.

Estimates of the average elevation of the 30 townships range from 1,040 to 1,250 feet above sea level, with an average for the county of 1,130 feet. Minnesota Lake Township has the lowest altitude and Kiester the highest. The highest elevation is about 1,400 feet, and the lowest (the valleys of the Blue Earth and Maple Rivers and the level of Minnesota Lake) is slightly less than 1,000.

All the runoff and drainage waters eventually drain into the Blue Earth River, which flows northward into Blue Earth County and empties into the Minnesota River near the city of Mankato. A part of the runoff water from the hills in the southeastern part of the county collects in hollows in the glacial drift. A large part, however, drains into the East Branch Blue Earth River. The East Branch flows westward through the southern half of the county and into the main stream at the town of Blue Earth. Dunbar Township in the northeastern corner of the county is drained for the most part by Cobb River, which reaches the Blue Earth River through the Le Sueur River. The townships to the west—Minnesota Lake, Lura, and Delavan—are drained by the headstreams of the Maple River, which also reaches the Blue Earth River by way of the Le Sueur River.

Water supply

The entire county is supplied with an abundance of water for domestic requirements. Good water is easily obtained by digging or drilling to depths of 25 to 125 feet. At similar depths, artesian wells are also obtained from the water-bearing beds of gravel and sand included in the glacial drift. These wells occur in many townships, notably Dunbar, Minnesota Lake, Lura, and Clark. In Clark Township they are most abundant in the vicinity of Wells. The water is clear and cold, but hard. It contains magnesium and calcium bicarbonates in solution.

There are several lakes in the county. The largest is Minnesota Lake, a shallow lake covering an area of about 3 square miles in the northwestern part. Its northern edge reaches into Blue Earth County. One of the larger lakes, the former Lake Ozatanka, in Barber and Emerald Townships, has been artificially drained and its lakebed is now used for crops.

Vegetation

The county as a whole, including the rolling and hilly land, lies within the vast region of prairie vegetation that extends far west into the Dakotas. At the time of settlement, most of the county was covered with luxuriant tall native grasses. These grasses were dominated by big bluestem (*Andropogon gerardi*); other grasses on the better drained upland were little bluestem (*A. scoparius*) and side-oats grama (*Bouteloua curtipendula*), the latter on drier sites. On droughty

south-facing slopes and on sandier and shallow soils were sand dropseed (*Sporobolus cryptandrus*), porcupine grass (*Stipa spartea*), Junegrass (*Koeleria cristata*), prairie cordgrass (*Spartina pectinata*), and prairie-three-awn (*Aristida*), all vegetation of the dry prairie. In lower more poorly drained parts, sedge (*Carex*), common reed (*Phragmites communis*), common cattail (*Typha latifolia*), and bog grasses dominated, though there were occasional clumps of willows (*Salix*) and alder (*Alnus rugosa*) (*7, 8*).

Native timber was confined to relatively narrow belts on the bottom lands, along steep bluffs, and on uplands bordering streams. It also occurred in small groves along lake shores.

Among the timber now found on the bottom lands and lower valley slopes, cottonwood (*Populus deltoides*) is most prominent; some of the trees attain great dimensions. Other trees are soft maple (*Acer saccharinum*), black walnut (*Juglans nigra*), American elm (*Ulmus americana*), and American linden (basswood) (*Tilia americana*). Prominent among the bluffs are oaks, of which the red oak (*Quercus rubra*) is most common; boxelder (*Acer negundo*); quaking aspen (*Populus tremuloides*); and an undergrowth of American filbert (hazelnut) (*Corylus americana*) (*7*).

Kiester (*9*) gives an account by townships of the prairie and timber cover as it was very soon after settlement. He reports that Kiester and Rome Townships were entirely rolling prairie; Clark and Dunbar—boundless, treeless prairie; Elmore—rolling prairie; Emerald—prairie and timber; Seely, Blue Earth, Brush Creek, Prescott, Verona, Winnebago, Lura, and Minnesota Lake—prairie but timbered along rivers; Pilot Grove, Foster, Walnut Lake, Barber—prairie but timbered along lakes; Jo Daviess—rolling prairie but timbered at Pilot Grove; and Delavan—prairie and timber. Two sawmills were reported in the county—one in 1860 at Minnesota Lake, the other in 1863 at Walnut Lake.

Keister states that the settlers began setting out trees immediately after they arrived, and to such an extent that in a short time the prairie was dotted with planted groves. These groves rapidly became established, grew so fast, and became so thick that soon it was difficult to distinguish them from the native trees. They became welcome landmarks which broke the monotony of the landscape. Now, some 65 years later, a casual observer traveling through the county and noticing the many groves may not realize that this county was once an open prairie. The countryside today is not far different from the rolling landscape to the northeast, recognized by botanists as a transition belt between two great vegetative zones –the prairie to the west and southwest and the forest to the north, northeast, and east. Better protection against prairie fires since settlement has favored encroachment of trees onto the prairie.

Undisturbed areas of prairie on the better drained soils can seldom be found in the county at the present time. Nearly all of the native prairie sod has been turned under, and the little sod that has escaped the plow has been altered. Grazing has eliminated the bluestem (tall prairie grass) in the few natural pastures and meadows that still remain in the county, and bluegrass now dominates in these forage areas.

Early settlement and pioneer agriculture

In the year 1855, Faribault County was named and its boundaries defined. The first white settlers arrived that year. The county was a wilderness and the early settlers scattered. Roads were few and often deep in mud; the lowland was often flooded; and crops were light (*9*).

The first settlers were American-born. Most of them emigrated from New York, Pennsylvania, Ohio, Massachusetts, and Connecticut. Some had stopped enroute for a year or two in neighboring States to the east, particularly Wisconsin. In 1858, a colony from Scotland moved into Pilot Grove Township. Twenty years later Norwegians came in large numbers, and the present population of Emerald Township is made up largely of their descendants.

About 1861 the settlers began to farm in earnest. Previously, trapping and hunting had been the main activities. Buffalo are reported to have roamed the prairie; deer, elk, and fur-bearing animals were plentiful; and small game such as waterfowl and rabbit are still abundant.

The year 1864 stands out as one of the important years of immigration and land improvement. High prices and increased demand for wheat during the War Between the States brought in new settlers. Between 1863 and 1866, settlers began to take up land in the two last townships to be occupied (Rome and Kiester), in the south-central and southeastern part of the county. The absence of timber probably accounts for later settlement of these townships. During later years immigrants poured into the county, but most of them went farther west, as little available land remained.

Continuous wheat cropping, insect pests, diseases, and unfavorable weather conditions began to lower yields. In 1873 the grasshoppers nearly ruined the crops, and their devastation continued in different parts of the county for 4 or 5 years. Nevertheless, growing of wheat increased until 1878. That year the wheat crops were ruined by prolonged extreme summer heat (95° to 103° F.) and excessive summer rains (July 10 to 20), but under these hot and moist conditions, corn thrived and produced high yields. It then became apparent that farmers could prosper without producing wheat. The more progressive ones learned that, in general, soil and climatic conditions in the county favored corn over wheat.

The year 1879, like 1861, marked a new era of farming. Straight wheat farming had practically come to an end. That year brought improved farm machinery—the sulky plow, mower, horse rake, grain binder, and grain thresher—and the opening of a railroad. Larger acreages were put into many different crops; oats, barley, and corn acreages increased but in general those of wheat did not. As larger acreages were put into these feed crops, the number of hogs and cattle increased.

Population

The 1950 Federal Census reported a total population in the county of 23,879. Blue Earth, the largest town and county seat, had a population of 3,843; Winnebago, 2,127; and Wells, 2,475. According

to the United States Census of Agriculture for 1950, 10,924 people occupied dwellings on farms.

Industries and markets

Agriculture is the largest single enterprise, and all industries in the county are engaged in processing farm products. Three large vegetable canneries in Winnebago, Wells, and Bricelyn, and a combined cannery and frozen-food packing plant in Fairmont, Martin County, serve as markets for peas and sweet corn. Three large poultry processing plants in Wells, Winnebago, and Kiester, and a cooperative egg warehouse in Walters handle the poultry produce. An ice-cream factory at Blue Earth and creameries in nearly every village serve as outlets for dairy products. Sugar beets are marketed at a factory at Mason City, Iowa. The livestock, including beef cattle, hogs, and sheep, is usually trucked to packing plants at Albert Lea, Austin, South St. Paul, or centers in Iowa.

Transportation

There are lines of four railways in the county: The Chicago, Rock Island, and Pacific; the Chicago, Milwaukee, St. Paul, and Pacific; the Chicago and Northwestern; and the Chicago, St. Paul, Minneapolis, and Omaha. The county is also served by several truck and bus lines. United States Highway 16 crosses the county from east to west, and United States Highway 169 from north to south. These major highways are supplemented by many hard-surfaced State and county roads. Few farms are more than a mile from an all-weather road connecting them with market and trading centers. In 1949 there were 3,039 automobiles, 1,174 motortrucks, and 3,661 tractors on farms.

Farm, home, and social facilities

Farms generally have an attractive and substantial dwelling, a barn with one or more silos, and other buildings (fig. 12). Many of the farms are enclosed with woven-wire fences. Modern machines and equipment for efficient operations are prevalent. The 1950 United States Census of Agriculture reports a total of 2,470 farms in this county. In that year electric water pumps were reported on 1,813 farms; electricity on 2,254 farms; and telephones on 2,133 farms. The county is well supplied with churches and grade and high schools, and has school-bus service. Rural mail service reaches all points.

AGRICULTURE

This section is written primarily for those not acquainted with the agriculture of the county. Briefly discussed are farms and farm tenure, land use, crops, pastures, livestock and livestock products, farm power and mechanical equipment, and types of farms. The discussion is based on conditions existing at the time of survey and upon data from the United States Census of Agriculture.

Figure 12.—**Typical farmstead in Faribault County.**

Farms and farm tenure

According to the 1950 United States Census of Agriculture, 98 percent of the 445,152 acres of the county was farmland. The number of farms reported was 2,470, and the average acreage was 180.2. The number of farms operated by owners (including part owners) was 1,515; by tenants, 946; and by managers, 9.

Land use

In the agricultural census of 1950, 2,368 farms reported a total of 381,337 acres of available cropland. Of this, 352,043 acres was harvested. There was 26,959 acres in pasture, and 12,782 acres in woodland. The remaining acreage was wasteland or was occupied by villages and towns, farmsteads, feed lots, roads, and so on.

Crops

Faribault county is located in the southwestern livestock- and grain-farming area of the State (*5*). Farming is based on grain production supplemented by livestock. Corn is the leading crop. Until 1940, few soybeans were grown, but the acreage has increased greatly since then. At present the county ranks first in the State in production of soybeans. Acreages of the principal crops are given in table 9.

Corn is usually planted in checkrows or drilled in about the middle of May. The crop is cultivated about three times unless weather or more urgent farm operations interfere. All the corn planted is hybrid. Varieties most common are those with a 105- to 110-day maturity rating. Row-crop tractors are used for cultivation. Harvesting is done for the most part with mechanical pickers. The corn is fed on the farm or sold on the market.

TABLE 9.—*Acreage of principal crops and number of bearing fruit trees and grapevines in Faribault County, Minn., in stated years*

Crops	1929	1939	1949
	Acres	*Acres*	*Acres*
Corn, all	122, 847	122, 604	149, 296
For grain	99, 915	112, 199	141, 421
For silage	5, 073	6, 305	5, 108
Small grains threshed:			
Oats	81, 803	91, 818	87, 894
Barley	25, 242	27, 789	2, 788
Wheat	8, 692	5, 667	1, 267
Flaxseed	6, 998	14, 256	15, 435
Rye	3, 982	472	413
Sugar beets	5, 099	4, 541	1, 162
Soybeans	23	1, 504	52, 095
Vegetables harvested for sale:			
Sweet corn	6, 647	3, 064	6, 998
Peas	897	2, 654	4, 145
Potatoes for sale and home use	1, 064	1, 161	300
Hay and forage:			
All hay	41, 275	35, 275	23, 648
Alfalfa	11, 065	17, 680	10, 463
Timothy and clover, alone or mixed	10, 124	5, 023	5, 171
Other tame hay	4, 085	4, 294	2, 091
Wild hay	16, 001	8, 278	5, 923
	Number	*Number*	*Number*
Apple trees	25, 919	5, 652	7, 831
Pear trees	19	20	86
Cherry trees	311	1, 275	191
Plum and prune trees	2, 652	1, 337	1, 612
Grapevines	1, 701	503	639

Soybeans, the most important cash crop, rank third in total acreage planted. They are drill-planted in May in the same manner as some of the corn. The rows are cultivated with corn cultivators and the crop is harvested with combines. The soybeans are hauled to elevators, from which they are shipped to markets in Iowa and Minnesota.

Oats are the most important small-grain crop. They are produced mainly for farm consumption. Oat varieties have changed rapidly during the past years. Oats are planted as early in April as possible in order to assure early maturity and thereby avoid the yield-decreasing summer heat. They are harvested early in July.

Other small grains include flaxseed, barley, rye, and wheat. During recent years the flax acreage has been greater than that of most of the other small grains, but the number of acres of this cash crop varies greatly from year to year. Rye has never been an important crop in the county. Wheat has been decreasing in acreage, and in 1949 less than 1,300 acres were harvested.

Sugar beets was an important cash crop in the county in 1925–30. The acreage has decreased, apparently because of prevalence of beet diseases, shortage of labor, and competing cash crops. The introduction of labor-saving machinery may slow this decrease.

Canning-crop acreages vary greatly with the demand. Often the best 10 or more acres of a field are selected for these crops. They are then grown under technical supervision of factory field men assigned to different areas.

Hay and forage crops are grown almost entirely for consumption on the farm. Alfalfa is the most important hay crop. It is most commonly grown in the southeastern part of the county, where it is seeded either alone or with bromegrass or timothy, with oats as a companion crop, and left for several years. Two to three cuttings are made every year. Wild hay has been confined to poorly drained areas. About two-thirds of these areas have been drained, and soil that formerly produced wild hay now produces corn and soybeans.

Pasture

Acreages in pasture occur throughout the county; the largest total acreage is in the southwestern part. The soils most likely to be in pasture are Storden soils; Mixed alluvial land; Peats and Mucks; Comfrey silty clay loam, 0 to 1 percent slopes; and undrained areas of the nearly level Webster, Marna, Beauford, and Glencoe soils.

Pasture vegetation on the Storden soils consists dominantly of Kentucky bluegrass mixed with clover. Undrained areas of Peat used for pasture support a large proportion of wiregrass (sedges), but on several partially drained peat bogs, reed canarygrass has been seeded. Most of the poorly drained Webster and associated soils are in marshgrasses, including sedges. A variety of grasses, all growing vigorously, are found in the bottom lands, as these soils have a high carrying capacity.

Livestock and livestock products

Cattle raising has been a major farm enterprise in this county from the time of early settlement. Cattle are produced throughout the county. Most of the dairy cattle are raised in the hilly areas in the southeastern part, where they provide an outlet for the hay and pasture necessarily produced on the hilly land in this area. The principal breeds of dairy cows are Holstein and Guernsey. The cattle used for beef production are largely mixtures of Hereford, Shorthorn, and Aberdeen Angus. There are several purebred herds of these breeds. Dairy products are marketed through local creameries, and beef cattle are trucked to nearby packing centers.

About 40 percent of the farm income in the county is derived from hogs. The number of hogs has increased from 62,072 in 1940 to 100,823 in 1950. Hogs are raised throughout the county but are most common on the nearly level farms. The principal breeds are Duroc-Jersey, Hampshire, Poland China, and Chester White. Hogs are shipped to the same markets as beef cattle.

Sheep have never been numerous but farm flocks of 50 or more are scattered throughout the county. The number of sheep has decreased from 12,442 in 1930 to 10,832 in 1950. The principal breeds are Shropshire and Hampshire. In 1950, 63,605 pounds of wool was shorn.

Poultry production is another important farm enterprise. Besides chickens, quite a number of turkeys and a few ducks and geese are

raised. The number of livestock on farms in Faribault County is given in table 10.

TABLE 10.—*Principal kinds of livestock on farms in Faribault County, Minn., in stated years*

Livestock	1930	1940	1950
	Number	*Number*	*Number*
Cattle and calves	49,407	[1] 49,416	35,841
Hogs and pigs	111,414	[2] 62,072	[2] 100,823
Sheep and lambs	12,442	[3] 15,179	10,832
Horses and mules	14,211	[1] 9,684	2,838
Mules and mule colts	314	[1] 173	42
Chickens	[1] 355,661	[2] 383,919	[2] 472,089
Turkeys	[4] 8,901	[2] 9,469	[2] 84,872

[1] Over 3 months old, Apr. 1.
[2] Over 4 months old, Apr. 1.
[3] Over 6 months old, Apr. 1.
[4] Raised during preceding year.

Farm power and mechanical equipment

During recent years there has been a great increase in the quantity of farm machinery in the county. The number of tractors has increased from 2,119 in 1940 to 3,661 in 1950. The machinery commonly used on an average farm is as follows: Row-crop tractor with cultivator and other attachments, grain binder, grain drill, disk, field cultivator, harrow, mower, side-delivery rake, hay loader, manure spreader, and other minor equipment such as wagons and hayracks. Many farms also have a field ensilage cutter and hay baler, and some have grain threshing machines.

Electrical power is used on most farms to operate mechanical equipment such as milkers, cream separators, and water pumps.

Types of farms

In 1950, according to the United States Census of Agriculture, there were 875 livestock farms, 731 general farms, 661 field-crop farms, 76 poultry farms, 16 vegetable farms, 20 dairy farms, and 91 miscellaneous and unclassified farms.

HOW THE SOILS OF FARIBAULT COUNTY WERE FORMED AND HOW THEY ARE CLASSIFIED [2]

Soils are formed by the combined influence of climate, vegetation and other living matter, soil parent materials, topography, and time—plus man's effect. Since the factors work simultaneously, it is not often possible to isolate the influence of any one. Each factor must be considered with due regard to the influence being exerted by the others.

[2] For an excellent review of the morphology, genesis, and geography of the zonal Brunizem (Prairie) soils of the upper Mississippi Valley of which Faribault County is a part, see the paper by Smith, Allaway, and Riecken (*12*).

Climate and living matter are the active forces that over periods of time act upon soil parent materials. Certain soil characteristics therefore can be directly related to them. Since these dynamic influences vary from place to place, they are often the main causes of major differences in soils.

Factors of Soil Formation as Related to Faribault County

The soils in this county started to form soon after the deposition of the parent materials by glacial ice or by resulting meltwater. A soil catena illustrating the relationship of some of the genetic forces to soil formation is given in table 11 for five of the soils. A soil catena is a group of soils that have formed from similar parent materials but that exhibit significant differences because thay have developed under different conditions of slope and drainage.

Climate

The extent of the effect of climate upon soil development is expressed in broad soil zones. Climate determines to a large degree the type of vegetation, which in turn has pronounced effects on the soils formed under it. For example, there is a relationship between the tall grasses of the humid and subhumid regions and the dark-colored (nearly black) soils like those in Faribault County. On a broader scale, the formation of the brown soils in the western part of the United States has been influenced by the short grasses, and the formation of light-colored soils in the north and northeast, by the cool climate and forest cover.

Many soils within the broad Prairie soil belt, which includes all of this county, have characteristics caused in part by soil conditions that result from local differences in relief, drainage, and parent material. These local differences throughout the county may be the cause of the existence of different major soil types even in close proximity. For instance, Storden soils developed under warmer and drier (xerophytic) local soil conditions on well-drained slopes, and at the crests of hills. Under this environment soil temperatures were higher than on more level areas, and drier conditions made the growth of grasses less vigorous. Higher temperatures combined with greater aeration resulted in a more complete decomposition of organic residues from plant growth. Clarion soils formed under slightly moister and cooler conditions that favored more vigorous vegetative growth and a slightly slower rate of decomposition. The Webster soil formed under a still wetter and cooler soil climate that not only favored ranker growth of marsh grasses but much poorer aeration and slower decomposition. Peats and Mucks formed under excessively moist conditions in former lakes, ponds, or basins where the water table was permanently at or very near the surface and plant remains were thereby preserved.

Living matter

Living matter contributing to soil formation includes microorganisms, vegetation, and many soil-inhabiting animals. With the coming of vegetation, soil formation really began. The roots of liv-

TABLE 11.—*Some genetic forces that affect the development of a catena*

Genetic forces	Soil catena				
	Storden	Clarion	Nicollet	Webster	Glencoe
Drainage	Somewhat excessively drained.	Well drained	Moderately well drained.	Imperfectly to poorly drained.	Very poorly drained.
Relief	Rolling to hilly	Undulating to gently rolling.	Gently undulating.	Nearly level	Nearly level (slightly depressed).
Spring soil temperature [1]	Very warm to warm.	Warm	Warm to cool	Cool	Very cool.
Organic matter [1]	Low to medium	Medium to high	High	High to very high	Very high.

[1] Relative terms relating to Faribault County.

ing and dead vegetation accelerated the chemical weathering of the assorted glacial material, added organic matter to it, and held it in place. As the organic matter decomposed, the nutrient elements in it, such as phosphorus and nitrogen, were released for other plants to use. The native vegetative cover is given in the section on vegetation under General Features of Faribault County.

The kind of plants and their rate of growth and decomposition greatly influenced soil characteristics throughout the county. The native grasses have myriads of fibrous roots that in most places penetrate the soil 10 to 20 inches and in some to 36 inches or deeper. The soils of this county have developed under the dominating influence of tall grass vegetation. They have thus accumulated to a depth of 10 to 20 inches relatively large amounts of organic matter in the surface layer. The depth of organic matter is much greater than in the soils developed under forest vegetation to the east and north and in those developed under the short-grass vegetative belt on the western Great Plains.

Within the county the amount of organic matter accumulated in the soil varies with such local factors as slope, drainage, and texture of parent material. This is shown in figure 3. The excessively drained, till-derived Storden soils on hilly topography, at the right of the diagram, have accumulated the least amount of organic matter. With decreasing drainage and slope, the organic-matter content increases in the other till-derived soils. The very poorly drained Glencoe soil in slightly depressed flats is thus very high in organic matter.

Soil parent material

According to geologists, several major continental ice sheets have covered all of Faribault County (*6*). Four of them, listed in the order in which they occurred—Nebraskan and Kansan stages and the Iowan and Mankato substages of the Wisconsin stage—left their marks on the county. The last ice sheet, represented by the Mankato substage, covered the earlier glacial drifts so completely and thickly that no exposure of the older drifts can be found.

The glaciers were the dominant force that shaped the landscape and deposited the soil-forming materials. Fully 90 percent of the soils in the county are derived from deposits of glacial till. Large areas of medium and moderately fine textured glacial till were deposited during the last glaciation as level, nearly level, and gently undulating till plains and rolling to hilly moraines.

In this county much of the till deposited directly by this glacier was subsequently reworked in varying degrees by waters of a glacial lake that formed in front of the retreating ice sheet in the basin of the Blue Earth River. The original till deposit was partially sorted, leveled, and reworked by the action of the lake into modified till or a water-sorted mixture of clay and sand. Later, very small amounts of the coarser water-sorted material were sorted again by wind. The glacial lake covered a wide area north of the Blue Earth River, where uniformity of relief and of texture of parent material can now be found. The surface ranges from level to gently undulating. Stones are rare.

The glacial lake is considered to have been deepest—50 to 125 feet (*14*)—in the northern part. Here clays and silts deposited in the quiet and deep waters are the parent materials for the Beauford soil. Silt and very fine sand deposited in shallower lake waters are the parent materials for the Truman soils, and the present-day Beach sand consists of wave-worked deposits.

Where the till had not been reworked by lake waters, as in the southeastern part of the county, it is more variable in composition and topography. It consists of mixed sands, silts, clays, and a few stones and boulders. The few deposits of alluvium have been laid down by running water on the flood plains of the present-day streams.

Topography

Soil formation is greatly modified by relief. For this reason many soil types in the county are roughly defined by relief. Gradient, pattern, and length of slope have a very great effect on the amount of water entering the soil, especially in fine-textured soils. On steeper slopes, more of the water runs over the surface and less penetrates the soil.

Internal drainage, or movement of water through the soil, is only generally related to relief. The porosity and permeability of the parent material have a greater influence on soil development. As the soil becomes more porous or permeable, the slope has less influence. For example, the Dickinson soils are somewhat excessively drained, even though they are on nearly level relief, because they are highly permeable. Less permeable soils of the same relief, like the Beauford, are poorly drained because the water that enters percolates very slowly through the surface soil and subsurface soil to the lower horizons or water table. These soils thus became swampy, grasses grew luxuriantly and decayed slowly, and large reserves of organic matter accumulated. Depressed flats are characterized by very poor drainage and a permanently high water table near or even at the surface.

The plant cover also lessens the effect of slope. Thin plant cover will favor natural (geological) erosion because of the increased movement of water over the surface. On the hilly to rolling, excessively drained Storden soils, less water is available to plants than on the undulating and gently rolling Clarion. The soil profile of the Storden soils is therefore shallower.

Time

Soil-forming processes take considerable time, yet soil age is not merely a function of time in years. The soils of Faribault County are of recent origin, having formed since the close of the Pleistocene epoch. Previous estimates of geologists of some 50,000 years since the retreat of the last glacier from southern Minnesota have been cut down to about 10,000 years by more recent estimates derived from studies of radioactive carbon in the deposits.

The relatively shallow depth to lime carbonates in most of the soils and the low degree of weathering of the parent material of some soils are further evidences of their newness. One of the most striking

changes that has taken place in the formation of the dominant soils in this county is the accumulation of organic matter and the development of a dark surface soil with distinct granular structure.

The effect of time is difficult to appraise, partly because of the little difference in the geological ages of the various parts of the county. The most recent soils, which show very little alteration of the parent material other than accumulation of organic matter, are represented by Mixed alluvial land and recent lake deposits such as Beach sand and Blue Earth silty clay loam. Peats and Mucks are also of very recent origin.

The till-derived soils in the county, all of about the same age and older than the above-mentioned soils, show little or no accumulation of clay in the B horizon. This is an indication of youthful soils. Studies on older parent materials in Iowa indicate that, for example, if the parent material from which the Webster soil developed had been older, a Planosol rather than a Humic Gley (Weisenboden) would have developed (*12*).

Man's effect on soils

Important changes take place in the soil when it is put under cultivation. Some of these changes have little effect on soil productivity, whereas others, such as excessive erosion, deterioration of soil structure, and loss of organic matter, may have drastic effects.

One of the most easily observed changes is caused by water erosion. In many cultivated fields, particularly on gently rolling to rolling slopes, part of the surface soil and, in some places all of it, has been removed by erosion. On many nearly level fields, definite signs that surface soil is being blown away can be observed as one drives through the county in winter and notices the dark surface soil mixed with the snowdrifts in or near plowed fields. In a few nearly level cultivated fields of dominantly coarse-textured soils such as the Dickinson, recently formed fence dunes can be seen.

Some deterioration of soil structure has taken place under cultivation. The well-developed granular structure of the surface soil, so apparent under the virgin grassland, has begun to break down in many fields that are cultivated continuously. The surface soil in some of the fields tends to bake and harden upon drying rather than form granules as in soils under grassland. On some fields of the finer textured soils that have been continuously plowed and cultivated when too wet, the surface has puddled and is less able to absorb water.

Subsurface changes have also been observed. In some fields of finer textured soil, a more compact layer that hardens upon drying and is less permeable has formed below the plowed layer. This is referred to as a plowsole or plowpan.

Field observations have shown that thickness of the surface soil, even in some fields that are not eroded, has been reduced in part by the compaction of the surface during cultivation and by the use of heavy machinery.

In many cultivated fields there has been a slight change in color from nearly black when moist to a lighter color. Little data are available to indicate what percentage of the organic matter has been

lost by cultivation with or without erosion. Figures in Iowa indicate that the organic matter has been reduced about one-third by causes other than erosion (*12*). To date the soils of Faribault County have not suffered irreparable loss of organic matter. Land-use practices have shown that it is not economically feasible to maintain so high a reserve of organic matter as was originally found under native grasses. It is necessary, however, to keep organic matter at a safe and economical level for crop production. Studies are needed on what the level should be and how it may vary according to soil and to soil-management practices.

Classification of Soils

The soil series of Faribault County are classified in the higher categories—order, suborder, and great soil group—in table 12.

Soils are grouped into orders on the basis of how much their developed characteristics reflect the active forces of soil formation—climate and living matter (*2*). The zonal order consists of soils that have developed characteristics that reflect the full force of climate and living matter. The intrazonal order consists of soils having well-developed characteristics that reflect the direct influence of some local factor of relief or parent material as well as the influence of climate and living matter. In the azonal order are soils that have extreme youth and do not have well-developed soil horizon characteristics.

The three orders are divided into suborders, and the suborders, in turn, are divided into subgroups, or great soil groups. The suborder descriptions may be found in table 13. Great soil groups, defined for the most part upon the basis of common soil characteristics, are divided into soil series, and the series, in turn, are divided into soil types and phases.

The Prairie soils are the only representatives of the zonal order in this county. This group does not have strongly developed horizon differentiation in the county, however, and is referred to as minimal Prairie (*12*). The Clarion, Truman, and Dickinson series are the best representatives of this great soil group in the county.

The two intrazonal great soil groups—Humic Gley (Weisenboden) and Bog soils—have developed on nearly level areas and slightly depressed flats that have relatively high water tables. The fine texture of the parent material is partly the cause of the development of the Humic Gley. Bog soils have not been subdivided into series.

Great soil groups in the azonal order in the county—Mixed alluvial land and Regosols (Beach sand)—are derived from such freshly deposited materials that very little, if any, effects of climate and vegetation can be seen in the soil. Mixed alluvial land has no genetic horizons because it represents very recently deposited alluvium. Fresh Beach sands are representative of the Regosols.

Many soil series in the county are not true representatives of any one great soil group, since they tend to intergrade with other soil groups. For example the Volin may intergrade in some places with Mixed alluvial land and in others with the Humic Gley group; the

TABLE 12.—*Classification of soil series of Faribault County, Minn., in the higher categories* [1]

Order	Suborder	Great soil group	Series	Percent of county
Zonal	Dark-colored soils of semi-arid, subhumid, and humid grassland.	Prairie soils	Clarion, Nicollet, Truman, Terril, Volin, Dickinson, Lakeville, Storden, Guckeen	39.6
Intrazonal.	Hydromorphic soils of marshes, swamps, seep areas, and flats.	Humic Gley (Weisenboden) soils.	Webster, Glencoe, Marna, Beauford, Lura, Comfrey, Blue Earth, Harpster	54.8
		Bog soils: Peat and Muck		3.5
		Marsh		.9
Azonal		Mixed alluvial land		.8
		Regosols (Beach sand).		.4

[1] Adapted from HIGHER CATEGORIES OF SOIL CLASSIFICATION: Order, Suborder, and Great Soil Groups (*13*).

Nicollet, with the Humic Gley; the Storden and Lakeville, with the Regosols; the Comfrey, with Mixed alluvial land; and the Guckeen, with the Humic Gley. In one area bordering the bluffs of the Blue Earth River north of the town of that name, the properties of the Guckeen approach those of Gray-Brown Podzolic soils.

Morphology of the Soils of Faribault County

How the soil characteristics are tied up with soil-forming factors is brought out in the section, Factors of Soil Formation as Related to Faribault County. Morphological features for each soil series are given in the section, Soils of Faribault County, Their Use and Management. Descriptions of a representative type of each of three great soil groups in the county—the Prairie, the Humic Gley, and the Bog soils—are given in greater detail below.

Prairie soil

CLARION LOAM.—The morphological characteristics of a Clarion loam profile examined and sampled in the southwestern corner of the

county, Sec. 36, T. 101 N, R. 28 W, on a slope gradient of 4 percent is given below:

Sample No.	*Horizon*	
451543	A_{11}	0 to 2½ inches, fibrous root mat; very dark brown (10YR 2/2,[1] moist) and dark grayish-brown (10YR 4/2, dry) loam; medium granular.
451544	A_{12}	2½ to 9 inches, very dark brown (10YR 2/2, moist) and very dark grayish-brown (10YR 3/2, dry) loam; friable; medium granular structure; numerous grass roots and worm casts; few pebbles of mixed origin.
451545	A_3	9 to 15 inches, very dark brown (10YR 2/2, moist) and dark yellowish-brown (10YR 3/4, dry) heavy loam; friable; medium to coarse granular structure, granules coated with black and dark brown; crushes to dark yellowish brown; grass roots numerous and worm casts abundant; pebbles common.
451546	B_1	15 to 23 inches, yellowish-brown (10YR 5/4, moist) and (10YR 5/6, dry) loam; few old root channels and spots of very dark brown material; less friable than layer above; granular to subangular blocky structure; grass roots numerous; slightly vesicular; few worm casts; few pebbles.
451547 and 451548	B_2	23 to 34 inches, yellowish-brown (10YR 5/6, moist, and 10YR 5/8, dry) loam; friable to firm when moist, slightly plastic when wet; subangular blocky structure; aggregates crush to light yellowish brown; few grass roots; frequent pebbles and shale fragments.
451549	C_1	34 to 37 inches, yellowish-brown (10YR 5/6, moist, and 10YR 5/8, dry) loam; friable; many pebbles of granitic and dolomitic origin and shale fragments; calcareousness confined to lime coatings on pebbles rather than to soil mass.
451550 and 451551	C_2	37 inches+, light yellowish-brown (10YR 6/4, moist) and brownish-yellow (10YR 6/6, dry) loam till; highly calcareous; friable; structureless; shale fragments and pebbles of mixed origin common; dark specks of iron compounds present.

[1] Munsell color notations.

The vegetative cover at the site of the profile here described consisted of tall and short bluestem (*Andropogon gerardi* and *A. scoparius*), wild sweetpea (*Lathyrus*), goldenrod (*Solidago*), wild rose (*Rosa*), milkweed (*Asclepias*), and Kentucky bluegrass (*Poa pratensis*).

Humic Gley soil

Beauford silty clay.—The morphological characteristics of a Beauford silty clay profile examined and sampled northwest of the town of Blue Earth in Sec. 2, T. 102 N, R. 28 W, on a slope gradient of 0.5 percent, are given below:

Sample No.	*Horizon*	
451569	A_0 and A_{11}	0 to 3 inches, root mat and very dark gray (10YR 3/1, moist) and very dark grayish-brown (10YR 3/2, dry) silty clay.
451570	A_{12}	3 to 11 inches, very dark gray (10YR 3/1, moist) and very dark grayish-brown (10YR 3/2, dry) silty clay; well-developed fine to medium granular structure; aggregates firm when moist, sticky when wet; roots abundant.

Sample No.	Horizon	
451571	A_3	11 to 19 inches, grading downward to very dark brown (10YR 2/2, moist) and very dark grayish-brown (10YR 3/2, dry) silty clay; well-developed granular structure; aggregates firm when moist, sticky when wet; roots abundant.
451572	B_{11}	19 to 27 inches, very dark grayish-brown (10YR 3/2, moist) and dark grayish-brown (10YR 4/2, dry) clay; well-developed fine subangular blocky structure; aggregates are very firm when moist, very plastic when wet; roots frequent.
451573	B_{12}	27 to 32 inches, dark grayish-brown (10YR 4/2, moist) and dark-brown (10YR 4/3, dry) clay; well-developed fine subangular blocky structure; aggregates very firm when moist, very plastic when wet; roots frequent.
451574	B_{g1}	32 to 38 inches, dark olive-gray (5Y 3/2, moist) and olive-gray (5Y 4/2, dry) silty clay; well-developed fine subangular blocky structure; aggregates waxy and very firm when moist and very plastic when wet; roots less numerous than in layers above.
451575	B_{g2}	38 to 46 inches, olive (5Y 4/3, moist) and pale-olive (5Y 6/4, dry) silty clay; well-developed subangular blocky structure; aggregates very firm when moist and plastic when wet; occasional roots.
451576	C_{1g}	46 to 55 inches, olive (5Y 4/3, moist) and pale-olive (5Y 6/4, dry) silty clay loam mottled with yellowish brown and dark brown; massive; somewhat laminated; slightly vesicular.
451577	C_{2g}	55 inches +, gray (5Y 5/1, moist) and light olive-gray (5Y 6/2, dry) and yellowish-brown (10YR 5/6, moist and dry) silty clay; dominantly lacustrine clays and silts; highly calcareous; lime concretions common and iron stains (limonite) frequent.

This profile had a cover of bluegrass, alfalfa, and witchgrass; it was within an area of Marna silty clay loam, 0 to 2 percent slopes, so it is included as part of an area marked with the map symbol Ma.

Bog soil

The morphological characteristics of a Bog soil profile examined in the southwestern corner of this county, Sec. 2, T. 101 N, R. 28 W, in a partially drained depressed flat under a good stand of reed canarygrass are given below:

1. 0 to 15 inches, very dark grayish-brown (10YR 3/2, moist) and dark grayish-brown (10YR 4/2, dry) mixtures of muck and well-decomposed peat streaked with light-gray marl and containing pale-yellow remains of reeds; a few cracks develop when layer dries.
2. 15 to 27 inches, very dark grayish-brown (2.5Y 3/2, moist) well-decomposed peat streaked with light-gray marl and brown muck; fine granular; very friable.
3. 27 to 36 inches, mixture of olive-gray (5Y 4/2, moist) silt and marl and yellowish-brown (10YR 5/6, moist) peat interbedded; remains of reeds (Phragmites) present in peat; streaked with olive-gray calcareous mucky silt and dark reddish-brown peat.
4. 36 inches +, olive-gray (5Y 5/2, moist) and light-gray (5Y 7/2, dry) mixtures of silt and marl.

Physical and Chemical Analyses

Tables 13 and 14 give the mechanical analyses, acidity, organic-matter content, exchangeable cations, base saturation, and percentage

TABLE 13.—*Laboratory analyses of a Prairie soil (Clarion loam), a representative of one of the two most widely distributed great soil groups in Faribault County, Minn.*

Sample No.	Horizon	Depth	pH	Organic matter	Size class and diameter of particles (in m. m.): Very coarse sand 2–1	Coarse sand 1–0.5	Medium sand, 0.5–0.25	Fine sand 0.25–0.1	Very fine sand 0.1–0.05	Silt, 0.05–0.002	Clay <0.002	Other classes (in m. m.): 0.02–0.002	<0.005	>2
		Inches		*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
451543	A_{11}	0–2½	7.0	6.9	2.2	5.0	6.9	22.4	12.8	27.8	22.9	15.5	27.1	0
451544	A_{12}	2½–9	6.8	4.1	2.9	5.4	6.5	21.2	13.7	27.2	23.1	15.2	27.2	4
451545	A_3	9–15	5.8	2.4	2.3	5.1	6.5	20.4	13.1	28.3	24.3	16.5	28.7	3
451546	B_1	15–23	5.9	1.5	2.8	5.0	6.1	19.3	13.9	29.5	23.4	17.8	28.7	3
451547	B_2	23–28	6.0	.7	2.6	4.7	6.6	21.3	14.6	30.8	19.4	18.9	25.3	4
451548	B_2	28–34	6.2	.6	3.4	6.0	7.1	21.9	14.6	30.1	16.9	18.8	22.4	7
451549	C_1	34–37	7.7	.4	5.9	5.9	7.0	22.2	14.5	29.9	14.6	18.9	20.3	8
451550	C_2	37–46	8.1	.4	4.5	6.0	6.9	19.3	15.2	34.1	14.0	20.1	19.8	14
451551	C_2	46–58	8.2	.1	4.8	6.0	6.6	19.3	15.7	33.4	14.2	19.2	18.8	9

Sample No.	Horizon	Depth	Exchangeable cations (m. e./100 gm.): H	Ca	Mg	K	Mn	Na	Sum	Base saturation	$CaCO_3$
										Pct.	*Pct.*
451543	A_0	0–2½	3.6	20.9	6.2	0.7	0.09	0.1	31.6	89	
451544	A_1	2½–9	3.9	15.5	4.9	.2	.03	.1	24.6	84	
451545	A_3	9–15	5.8	11.4	4.0	.2	.03	.1	21.5	73	
451546	B_1	15–23	4.4	11.1	4.0	.2	.03	.2	19.9	78	
451547	B_2	23–28	3.3	10.2	3.6	.2	.03	.2	17.5	81	
451548	B_2	28–34	2.8	9.4	3.0	.1	.02	.2	15.5	82	
451549	C_1	34–37	.0	(1)	3.5	.2	.00	.3	(1)	100	4.9
451550	C_1	37–46	.0	(1)	3.3	.1	.00	.3	(1)	100	15.4
451551	C_2	46–58	.0	(1)	3.3	.1	.00	.3	(1)	100	17.5

[1] The chemical methods of analysis did not permit accurate determination of exchangeable calcium and total exchangeable cations in calcareous samples.

TABLE 14.—*Laboratory analyses of a Humic Gley soil (Beauford silty clay), a representative of one of the two most widely distributed great soil groups in Faribault County, Minn.*

Sample No.	Horizon	Depth	pH	Organic matter	Size class and diameter of particles (in m. m.): Very coarse sand 2–1	Coarse sand 1–0.5	Medium sand, 0.5–0.25	Fine sand 0.25–0.1	Very fine sand 0.1–0.05	Silt, 0.05–0.002	Clay <0.002	Other classes (in m. m.): 0.02–0.002	<0.005	>2
		Inches		*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
451569	A_0 and A_{11}	0–3	6.5	8.6	0.1	0.4	0.7	2.6	3.5	44.7	48.0	35.6	64.8	0
451570	A_{12}	3–11	6.5	8.1	.1	.3	.7	2.5	3.3	45.4	47.7	36.6	64.1	0
451571	A_3	11–19	6.1	6.4	.1	.3	.6	1.8	3.3	43.8	50.1	35.6	68.5	.5
451572	B_{11}	19–27	5.7	3.5	.0	.3	.4	1.2	2.5	40.8	54.8	35.4	75.2	.5
451573	B_{12}	27–32	5.4	2.3	.1	.3	.4	1.1	1.6	41.3	55.2	37.5	78.7	.5
451574	B_{g1}	32–38	5.6	1.5	.0	.4	.5	1.0	1.2	43.3	53.6	41.3	79.8	.5
451575	B_{g2}	38–46	5.9	1.0	.1	.5	.5	.8	.6	49.7	47.8	48.1	77.3	0
451576	C_{1g}	46–55	7.1	.3	.1	.7	.6	.7	.3	59.1	38.5	58.2	69.9	0
451577	C_{2g}	55–63	7.7	.2	.2	.4	.4	.7	.5	50.3	47.5	48.9	77.1	.5

Sample No.	Horizon	Depth	Exchangeable cations (m. e./100 gm.): H	Ca	Mg	K	Mn	Na	Sum	Base saturation	$CaCO_3$
										Pct.	*Pct.*
451569	A_0 and A_{11}	0–3	7.0	33.1	8.1	1.6	0.01	0.2	50.0	86	----------
451570	A_{12}	3–11	7.0	34.3	7.8	.7	.09	.2	50.1	86	----------
451571	A_3	11-19	10.3	28.4	7.8	.5	.06	.3	47.4	78	----------
451572	B_{11}	19-27	9.5	25.7	8.8	.4	[1]	.3	44.7	79	----------
451573	B_{12}	27-32	9.1	25.8	9.4	.5	[1]	.4	45.2	80	----------
451574	B_{g1}	32-38	7.8	25.2	9.1	.4	[1]	.4	42.9	82	----------
451575	B_{g2}	38-46	4.9	24.9	8.6	.4	[1]	.5	39.3	88	----------
451576	C_{1g}	46-55	2.7	24.2	8.0	.3	.00	.6	35.8	92	----------
451577	C_{2g}	55-63	.0	[2]	7.4	.4	.00	.5	[2]	100	14.4

[1] Trace.
[2] The chemical methods of analysis did not permit the accurate determination of exchangeable calcium and total exchangeable cations in calcareous samples.

of calcium carbonate for soils representative of two great soil groups (Prairie and Humic Gley).

The mechanical analyses suggest that there is slightly more clay in the A and B horizons in both of the soils represented (Clarion and Beauford) than there is in the underlying material. The larger amounts of clay may be due to weathering or to leaching of carbonates. There is a slightly greater accumulation in the Clarion soil. The Beauford soil of lacustrine origin is uniformly high in clay.

The organic-matter content of the Clarion loam is about normal for a modal virgin Prairie soil in southern Minnesota. The organic-matter content of the A horizon of the Beauford soil is higher than that of the Clarion and, as in the Clarion, decreases gradually with depth to the C_2 horizon.

For comparable horizons the exchangeable cations dominated by calcium are higher in the Beauford soil than in the Clarion. They are highest in surface horizons of both soils. They decrease gradually with depth, are lowest in the lower B horizon, and increase again in the calcareous parent material, which has more exchangeable calcium than any of the other horizons.

The calcium-magnesium ratios for the various horizons of the solum range for the most part from about 3:1 to 4:1, but are much higher in the C subhorizons.

The replaceable hydrogen content increases in the B horizons of both the Clarion and Beauford soils. The replaceable sodium is lowest in the A horizons and highest in the B and C horizons of both soils. The replaceable potassium is highest in the A horizons.

The pH values of both the Clarion and Beauford soils are high in the surface soil, decrease with depth, increase again, and are highest in the C horizons.

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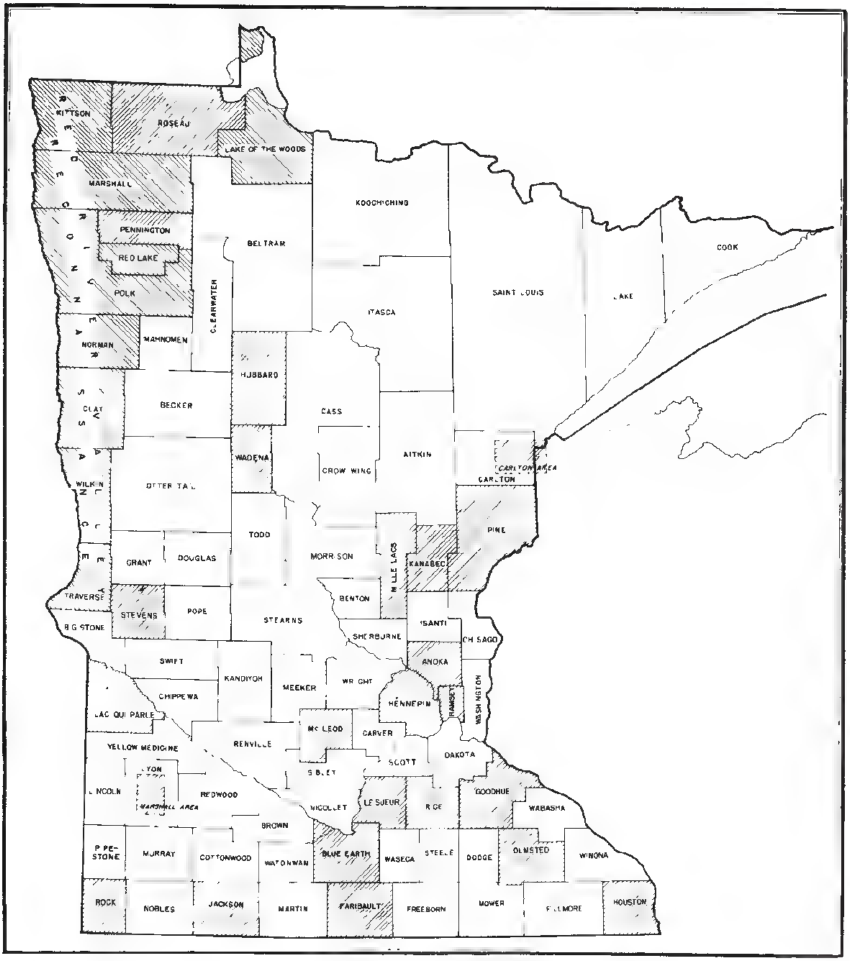

Areas surveyed in Minnesota shown by shading.

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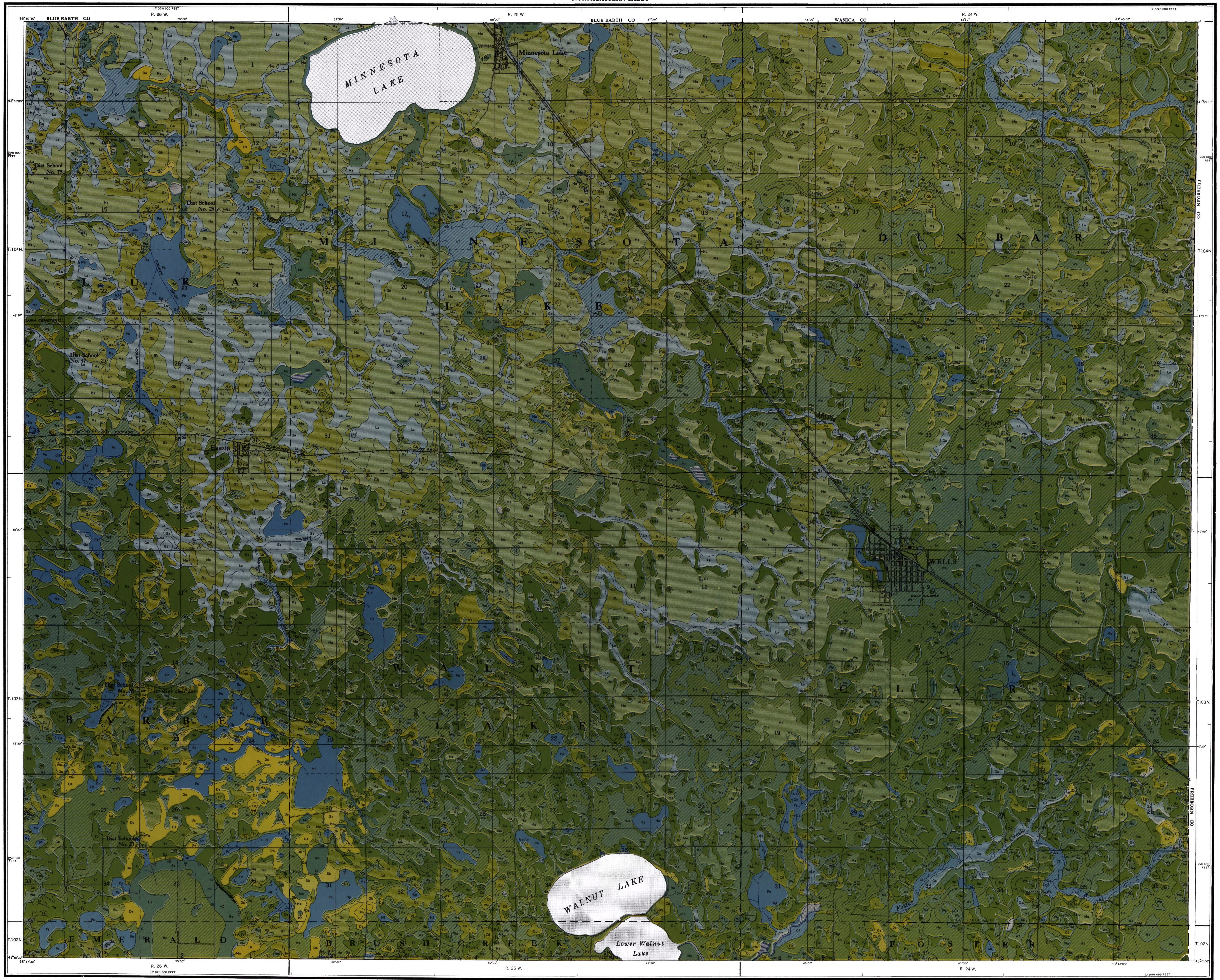
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MAP
FARIBAULT COUNTY–MINNESOTA
NORTHEASTERN SHEET

UNIVERSITY OF MINNESOTA
AGRICULTURAL EXPERIMENT STATION



LEGEND

Ba — Beach sand	Ce — Clarion silt loam, 2-7 percent slopes	Gb — Guckeen silty clay loam, 1-3 percent slopes	Md — Mixed alluvial land	Sb — Storden loam and silt loam, 13-30 percent slopes
Bb — Beauford silty clay, 0-2 percent slopes	Cf — Comfrey silty clay loam, 0-1 percent slopes	Gc — Guckeen silty clay loam, 2-7 percent slopes	Me — Muck	Ta — Terril loam and silt loam, 1-7 percent slopes
Bc — Blue Earth silty clay loam, 0-2 percent slopes	Da — Dickinson fine sandy loam, 1-7 percent slopes	Ha — Harpster silty clay loam, 0-2 percent slopes	Mf — Muck, shallow phase	Tb — Truman silt loam, 1-5 percent slopes
Ca — Clarion fine sandy loam, 1-7 percent slopes	Db — Dickinson fine sandy loam, 8-20 percent slopes	La — Lura silty clay, 0-2 percent slopes	Na — Nicollet and Clarion silty clay loams, 1-3 percent slopes	Tc — Truman silt loam, 6-12 percent slopes
Cb — Clarion fine sandy loam, 8-20 percent slopes	Dc — Dickinson loamy fine sand, 1-7 percent slopes	Ma — Marna silty clay loam, 0-2 percent slopes	Pa — Peat	Uc — Unclassified urban land
Cc — Clarion - Lakeville loams, eroded, 8-13 percent slopes	Dd — Dickinson loamy fine sand, 8-20 percent slopes	Mb — Marna silty clay loam, 2-5 percent slopes	Pb — Peat, shallow phase	Va — Volin silt loam, 0-2 percent slopes
Cd — Clarion loam, 8-12 percent slopes	Ga — Glencoe silty clay loam, 0-2 percent slopes	Mc — Marsh	Sa — Storden - Lakeville loams, eroded, 13-30 percent slopes	Wa — Webster silty clay loam, 0-2 percent slopes

SOIL MANAGEMENT GROUPING

MANAGEMENT GROUP 1
Nearly level, poorly and imperfectly drained silty clay loam underlain by limy loam and clay loam.

MANAGEMENT GROUP 2
Nearly level to gently undulating, poorly drained silty clay loam and silty clay underlain by silty clay and clay.

MANAGEMENT GROUP 3
Nearly level, very poorly drained (ponded) silty clay loam and silty clay underlain by silty clay loam and clay.

MANAGEMENT GROUP 4
Nearly level, imperfectly to very poorly drained, very limy silty clay loam underlain by limy loam and clay loam

MANAGEMENT GROUP 5
Nearly level to gently undulating, imperfectly and moderately well-drained silty clay loam underlain by silty clay and clay.

MANAGEMENT GROUP 6
Nearly level to undulating, moderately well-drained and well-drained silt loam and silty clay loam underlain by limy loam and clay loam.

MANAGEMENT GROUP 7
Undulating to gently rolling, well-drained loams and fine sandy loams underlain by limy loam.

MANAGEMENT GROUP 8
Undulating and gently rolling, excessively drained sandy loams.

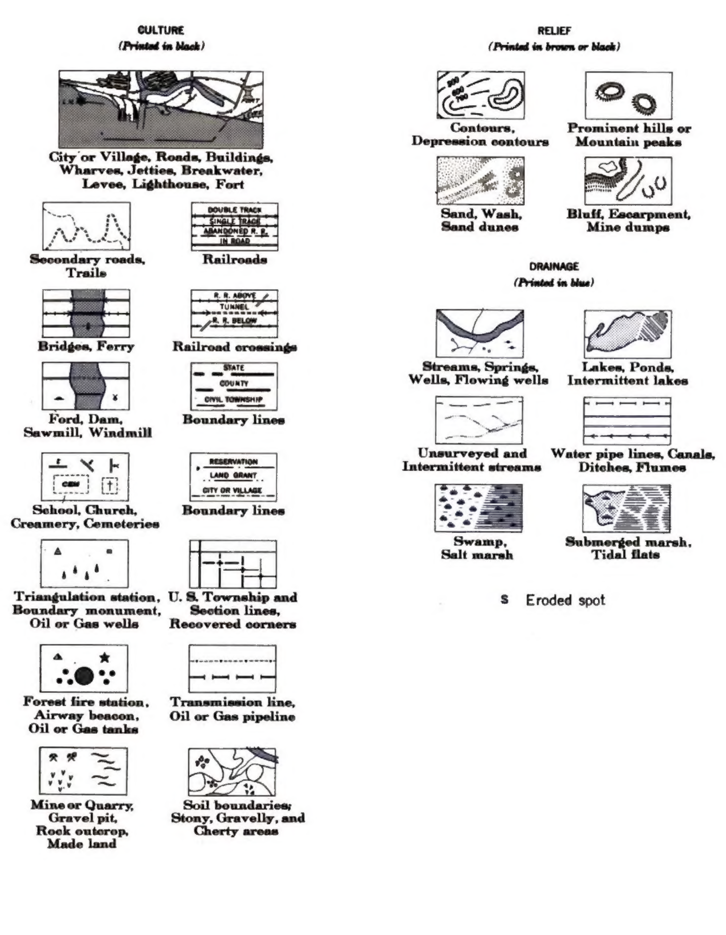
MANAGEMENT GROUP 9
Hilly, excessively drained soils

MANAGEMENT GROUP 10
Poorly drained soil of the flood plain

MANAGEMENT GROUP 11
Organic soils

MANAGEMENT GROUP 12
Miscellaneous land types

CONVENTIONAL SIGNS



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FARIBAULT COUNTY–MINNESOTA
NORTHEASTERN SHEET

Base map constructed by the Cartographic Division, Soil Conservation Service, USDA.
Soil survey and map construction from 1938 aerial photographs.
Polyconic projection, 1927 North American datum.
10 000 foot grid based on Minnesota (South) rectangular coordinate system.

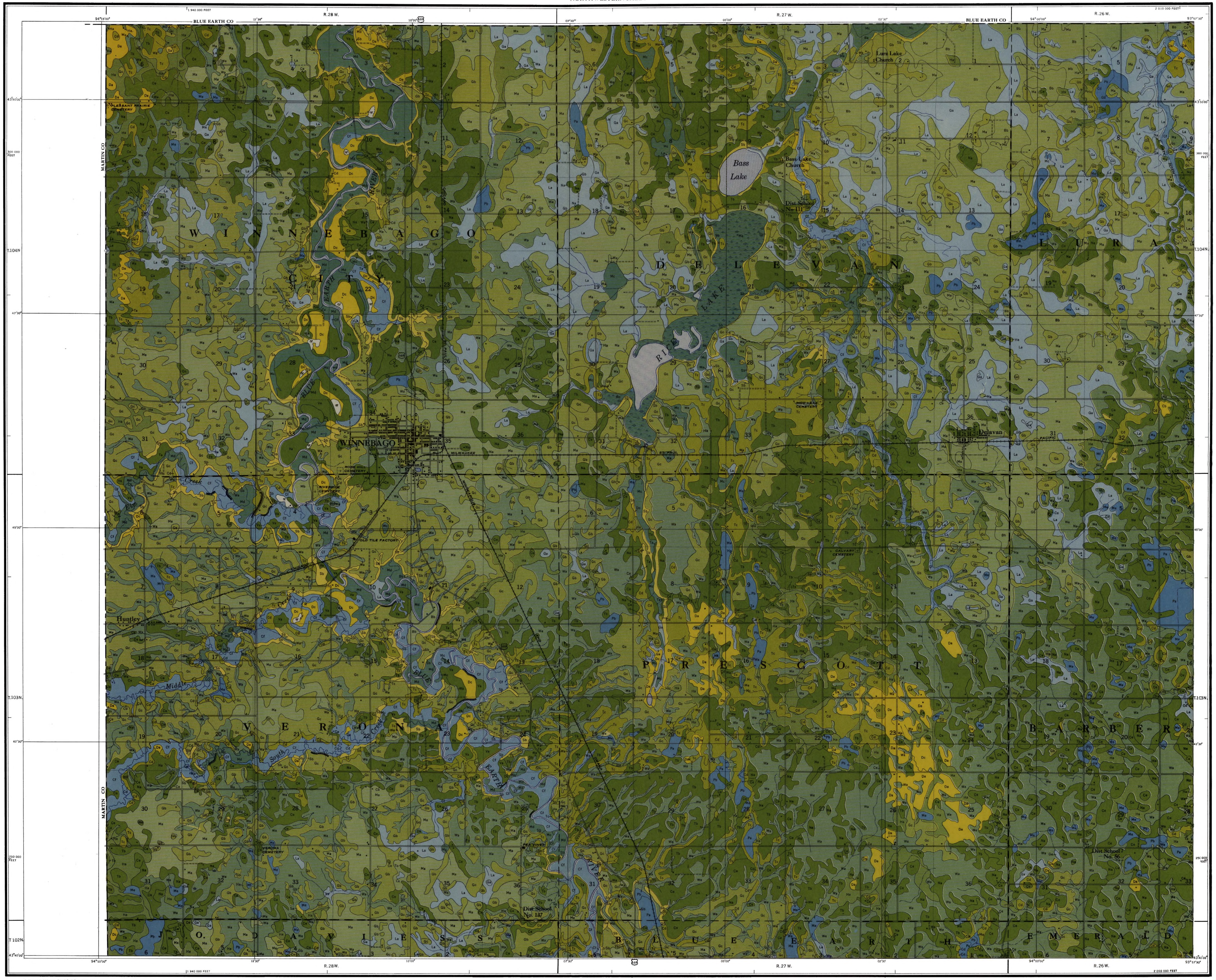
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MAP

FARIBAULT COUNTY–MINNESOTA

NORTHWESTERN SHEET

UNIVERSITY OF MINNESOTA
AGRICULTURAL EXPERIMENT STATION



LEGEND

- Ba — Beach sand
- Bb — Beauford silty clay, 0-2 percent slopes
- Bc — Blue Earth silty clay loam, 0-2 percent slopes
- Ca — Clarion fine sandy loam, 1-7 percent slopes
- Cb — Clarion fine sandy loam, 8-20 percent slopes
- Cc — Clarion - Lakeville loams, eroded, 8-13 percent slopes
- Cd — Clarion loam, 8-12 percent slopes
- Ce — Clarion silt loam, 2-7 percent slopes
- Cf — Comfrey silty clay loam, 0-1 percent slopes
- Da — Dickinson fine sandy loam, 1-7 percent slopes
- Db — Dickinson fine sandy loam, 8-20 percent slopes
- Dc — Dickinson loamy fine sand, 1-7 percent slopes
- Dd — Dickinson loamy fine sand, 8-20 percent slopes
- Ga — Glencoe silty clay loam, 0-2 percent slopes
- Gb — Guckeen silty clay loam, 1-3 percent slopes
- Gc — Guckeen silty clay loam, 2-7 percent slopes
- Ha — Harpster silty clay loam, 0-2 percent slopes
- La — Lura silty clay, 0-2 percent slopes
- Ma — Marna silty clay loam, 0-2 percent slopes
- Mb — Marna silty clay loam, 2-5 percent slopes
- Mc — Marsh
- Md — Mixed alluvial land
- Me — Muck
- Mf — Muck, shallow phase
- Na — Nicollet and Clarion silty clay loams, 1-3 percent slopes
- Pa — Peat
- Pb — Peat, shallow phase
- Sa — Storden - Lakeville loams, eroded, 13-30 percent slopes
- Sb — Storden loam and silt loam, 13-30 percent slopes
- Ta — Terril loam and silt loam, 1-7 percent slopes
- Tb — Truman silt loam, 1-5 percent slopes
- Tc — Truman silt loam, 6-12 percent slopes
- Uc — Unclassified urban land
- Va — Volin silt loam, 0-2 percent slopes
- Wa — Webster silty clay loam, 0-2 percent slopes

SOIL MANAGEMENT GROUPING

MANAGEMENT GROUP 1

Nearly level, poorly and imperfectly drained silty clay loam underlain by limy loam and clay loam.

MANAGEMENT GROUP 2

Nearly level to gently undulating, poorly drained silty clay loam and silty clay underlain by silty clay and clay.

MANAGEMENT GROUP 3

Nearly level, very poorly drained (ponded) silty clay loam and silty clay underlain by silty clay loam and clay.

MANAGEMENT GROUP 4

Nearly level, imperfectly to very poorly drained, very limy silty clay loam underlain by limy loam and clay loam.

MANAGEMENT GROUP 5

Nearly level to gently undulating, imperfectly and moderately well-drained silty clay loam underlain by silty clay and clay.

MANAGEMENT GROUP 6

Nearly level to undulating, moderately well-drained and well-drained silt loam and silty clay loam underlain by limy loam and clay loam.

MANAGEMENT GROUP 7

Undulating to gently rolling, well-drained loams and fine sandy loams underlain by limy loam.

MANAGEMENT GROUP 8

Undulating and gently rolling, excessively drained sandy loams

MANAGEMENT GROUP 9

Hilly, excessively drained soils

MANAGEMENT GROUP 10

Poorly drained soil of the flood plain

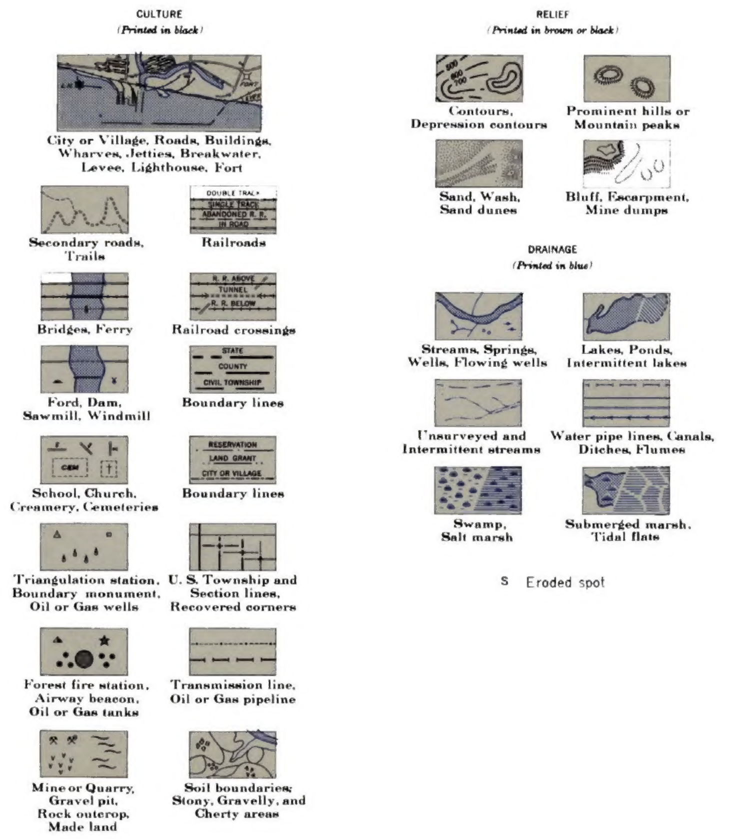
MANAGEMENT GROUP 11

Organic soils

MANAGEMENT GROUP 12

Miscellaneous land types

CONVENTIONAL SIGNS



s Eroded spot

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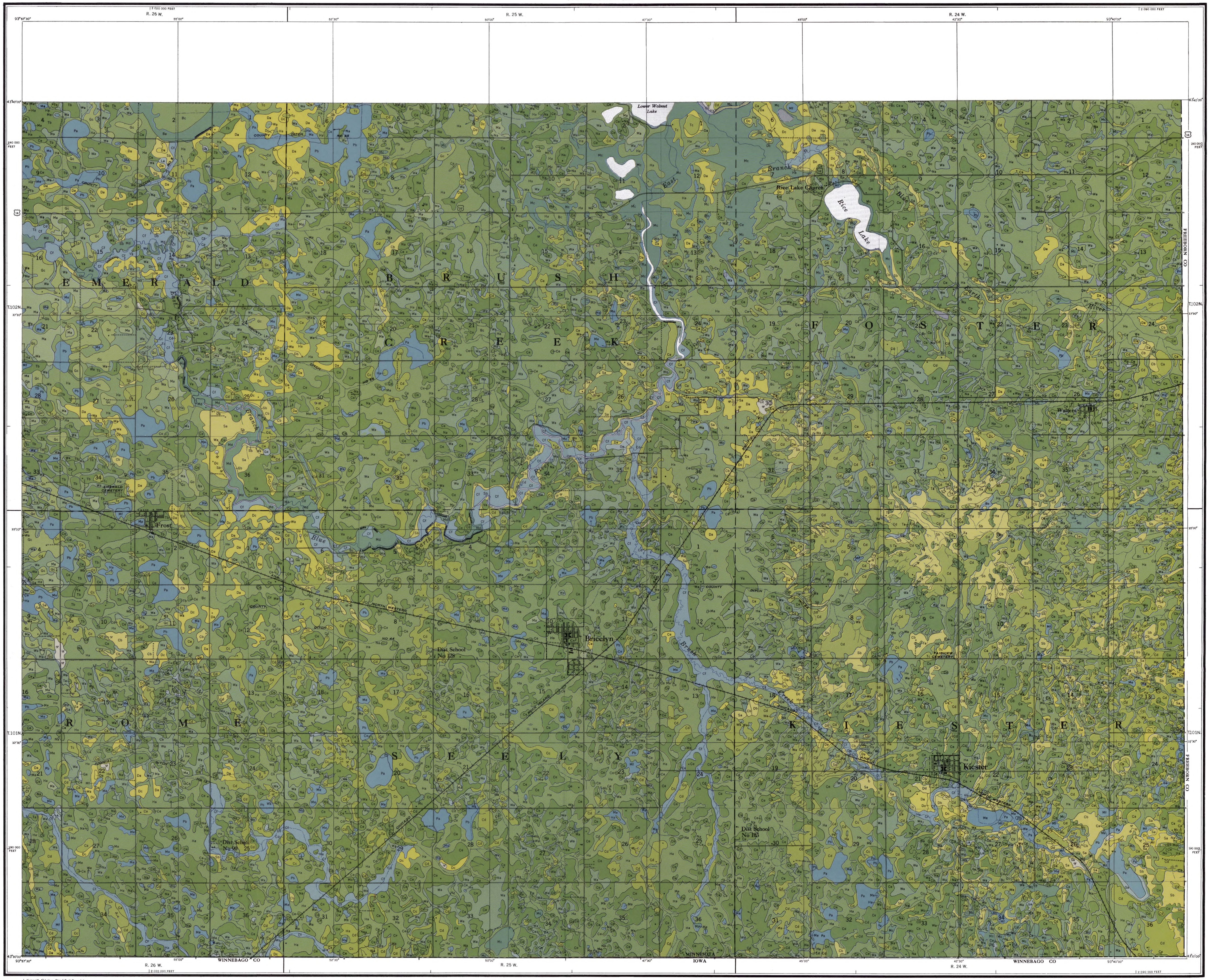
Polyconic projection, 1927 North American datum.
10 000 foot grid based on Minnesota (South) rectangular coordinate system.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MAP
FARIBAULT COUNTY–MINNESOTA
SOUTHEASTERN SHEET

UNIVERSITY OF MINNESOTA
AGRICULTURAL EXPERIMENT STATION



LEGEND

Ba Beach sand	Ce Clarion silt loam, 2-7 percent slopes	Gb Guckeen silty clay loam, 1-3 percent slopes	Md Mixed alluvial land	Sb Storden loam and silt loam, 13-30 percent slopes
Bb Beauford silty clay, 0-2 percent slopes	Cf Comfrey silty clay loam, 0-1 percent slopes	Gc Guckeen silty clay loam, 2-7 percent slopes	Me Muck	Ta Terril loam and silt loam, 1-7 percent slopes
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SOIL MANAGEMENT GROUPING

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MANAGEMENT GROUP 7
Undulating to gently rolling, well-drained loams and fine sandy loams underlain by limy loam.

MANAGEMENT GROUP 8
Undulating and gently rolling, excessively drained sandy loams.

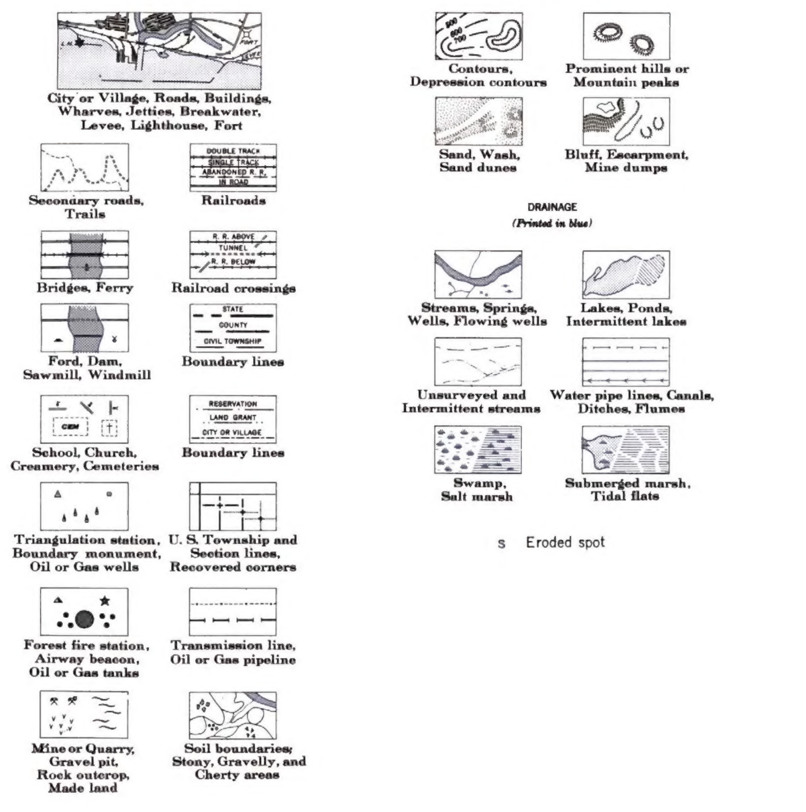
MANAGEMENT GROUP 9
Hilly, excessively drained soils

MANAGEMENT GROUP 10
Poorly drained soil of the flood plain

MANAGEMENT GROUP 11
Organic soils

MANAGEMENT GROUP 12
Miscellaneous land types

CONVENTIONAL SIGNS



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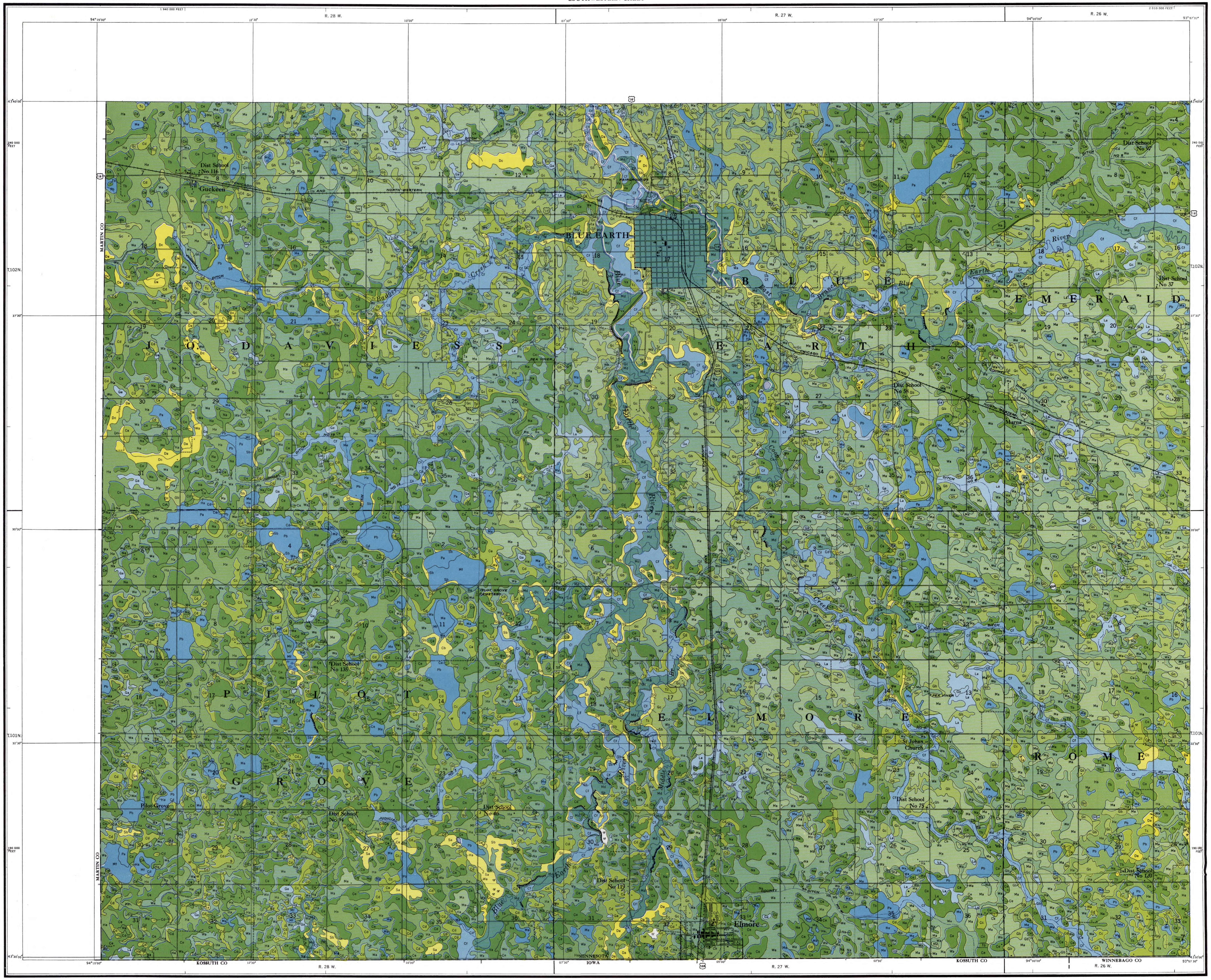
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MAP

FAIRBAULT COUNTY–MINNESOTA

SOUTHWESTERN SHEET

UNIVERSITY OF MINNESOTA
AGRICULTURAL EXPERIMENT STATION



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MANAGEMENT GROUP 7
Undulating to gently rolling, well-drained loams and fine sandy loams underlain by limy loam.

MANAGEMENT GROUP 8
Undulating and gently rolling, excessively drained sandy loams.

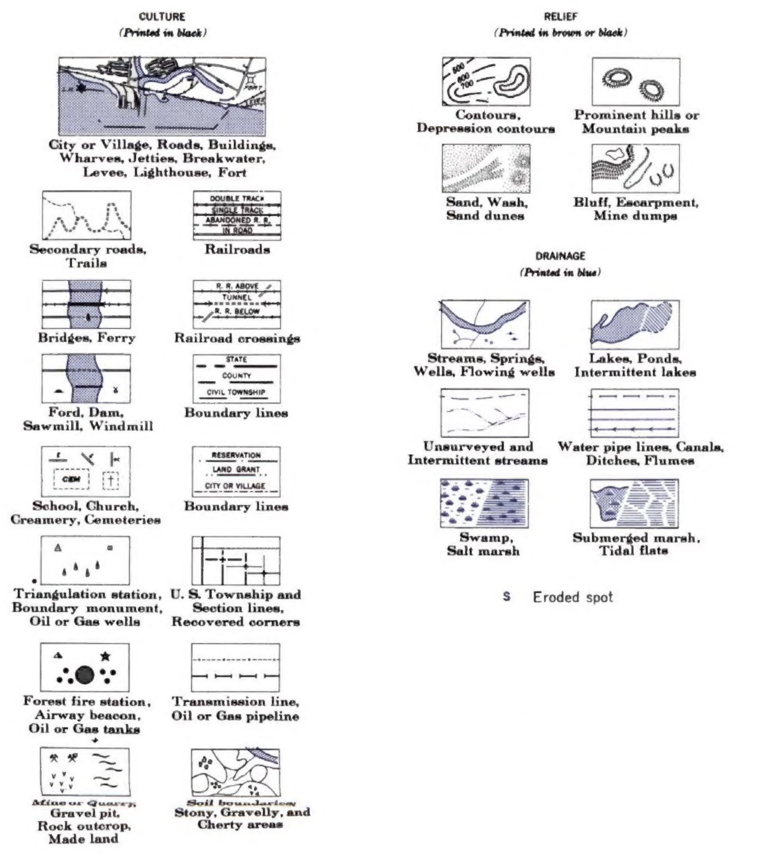
MANAGEMENT GROUP 9
Hilly, excessively drained soils

MANAGEMENT GROUP 10
Poorly drained soil of the flood plain

MANAGEMENT GROUP 11
Organic soils

MANAGEMENT GROUP 12
Miscellaneous land types

CONVENTIONAL SIGNS



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